REV-2

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Wholesale Distributors of Energy Equipment

2007 hydronics

design supply support

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2007 STOCK CARD

BOILERS
Buderus
Lochinvar
RayPak
Viessmann

BURNERS
Riello
Viessmann
Weishaupt

CIRCULATORS
Bell & Gossett
Grundfos
Taco

COMMODITIES
Black Steel Nipples
Black Steel Pipe
Brass Fittings & Nipples
Cast Iron Fittings
Copper Tubing & Fittings
Flare Fittings
Malleable Fittings
Pipe Hangers
Smoke Pipe
Threaded Rod
Unistrut

CONTROLS
Honeywell
Invensys
Taco
Tekmar
Viega

HEATING SPECIALTIES
Clic Hangers
Garber Oil Filters
Harvey Chemicals
Lenox Tools
Pipe Insulation
Ridgid Tools
Winter Guages

HVAC
First Company
Heatpack Coils
Hydro-Pac
IEC Fan Coils
Modine
Lifebreath / Nutech
Quiet One
Rheem / Rudd
Spacegard
Unico

HYDRONICS SPECIALTIES
Apollo Valves
Axiom
Bell & Gossett
Caleffi
Danfoss
Ecoflex
FlatPlate
McDonnell & Miller
Oventrop
Rhomar
Sparco / Honeywell
Taco
Watts
Webstone Valves

OIL TANKS
Highland Oil Tanks
Roth

PLUMBING SPECIALTIES
Ridgid ProPress
Viega PureFlow

RADIANT FLOOR HEATING
EZ Floor Insulation
Insultarp
Radiant Side Track
Viega ProRadiant

RADIATION
Buderus
Haydon
Myson
Radson
Runtal

THERMOSTATS
Invensys
Honeywell
Tekmar

VENTING PRODUCTS
Field
Protech
Tjernlund
Z-Flex
Hart & Cooley

WATER HEATERS
Buderus
Mega-stor
Superstor
Therma-Flow / Everhot
Turbomax
Viessmann

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Buderus

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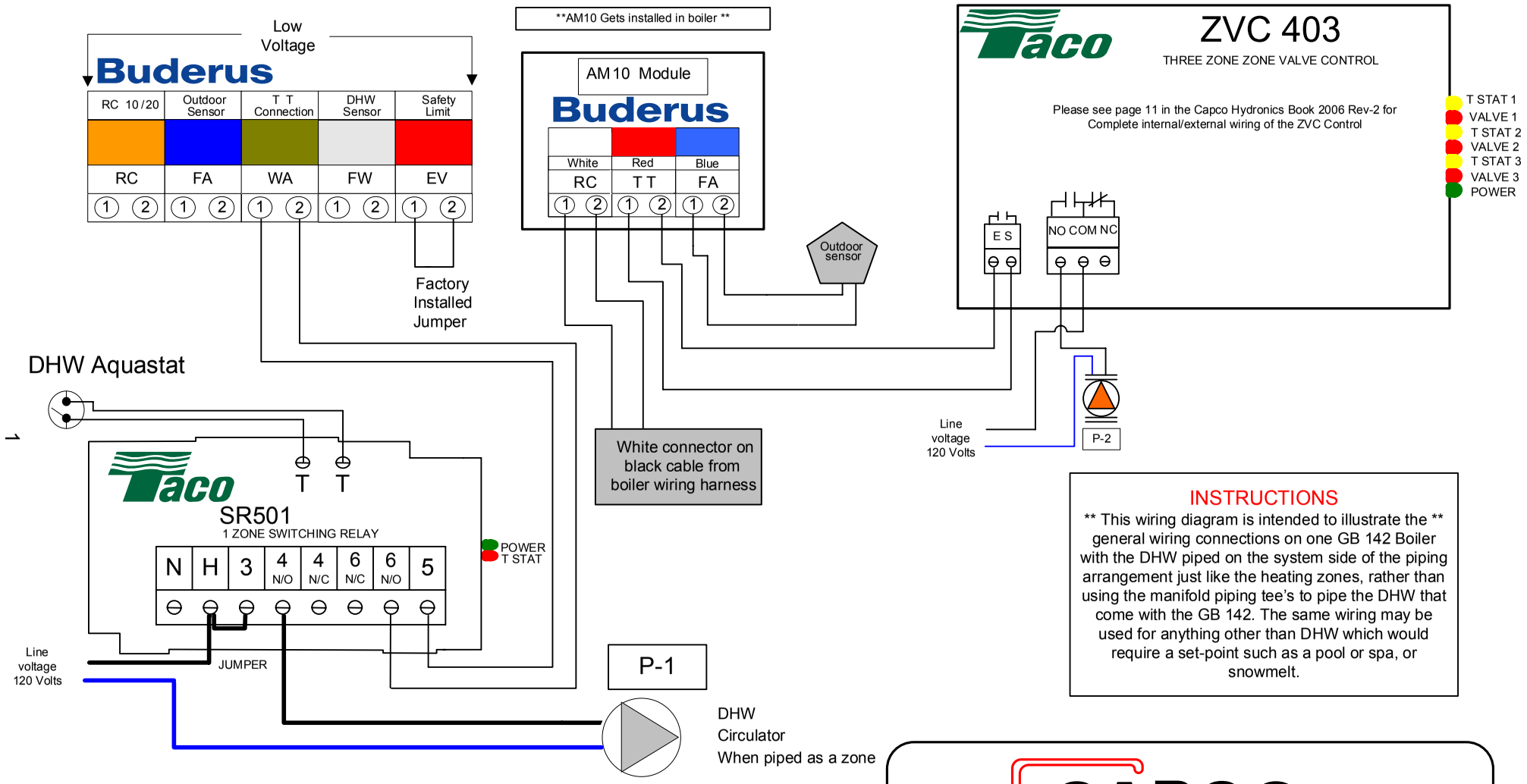
Wiring Diagram for a Single GB142 Boiler with Buderus AM10 reset & Taco ZVC Control



INSTRUCTIONS

** This wiring diagram is intended to illustrate the ** general wiring connections on one GB 142 Boiler with the DHW piped on the system side of the piping arrangement just like the heating zones, rather than using the manifold piping tee's to pipe the DHW that come with the GB 142. The same wiring may be used for anything other than DHW which would require a set-point such as a pool or spa, or snowmelt.

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GB142 With AM10, ZVC Control and DHW as a Setpoint piped off of System Piping

Michael Fox
09/06/2006

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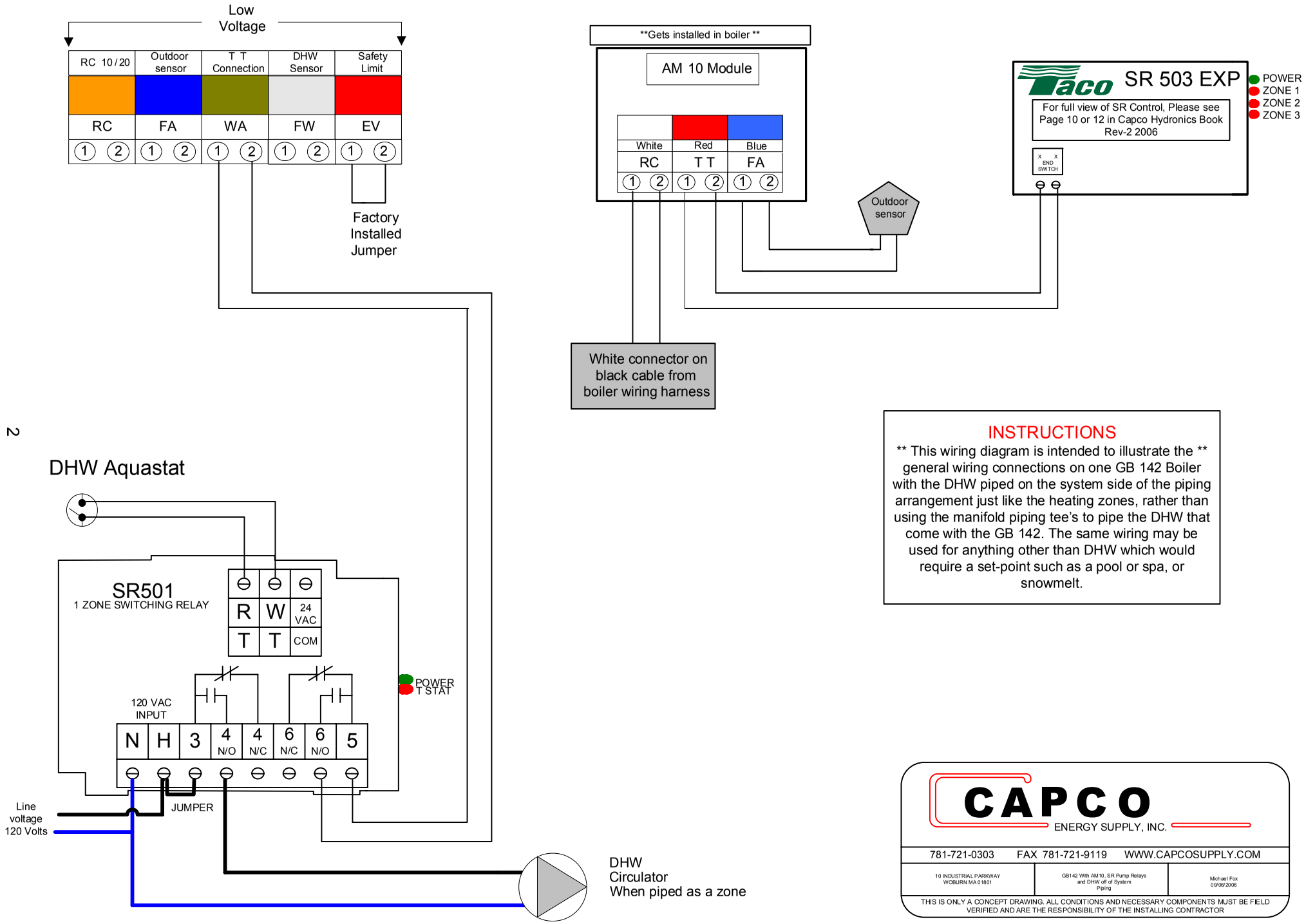
Wiring Diagram for a Single GB-142 Boiler with Setpoint Control



INSTRUCTIONS

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GB142 With AM10, SR Pump Relays and DHW off of System Piping

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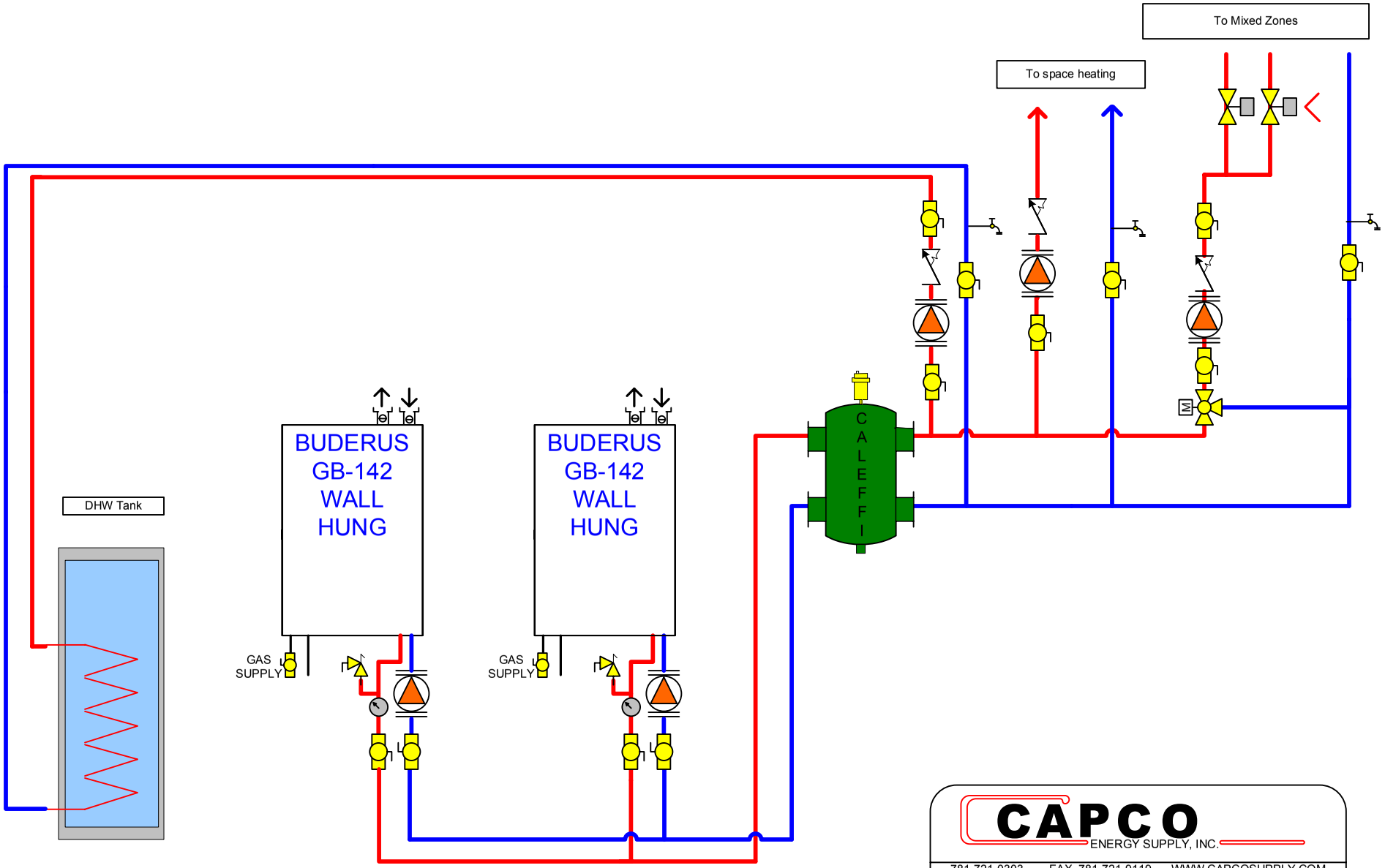
Piping Example for (2) GB-142's and DHW on system side of a Hydro Separator



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2 GB 142's PIPED WITH DHW
ON THE SYSTEM SIDE OF A HYDRO-
SEPARATOR

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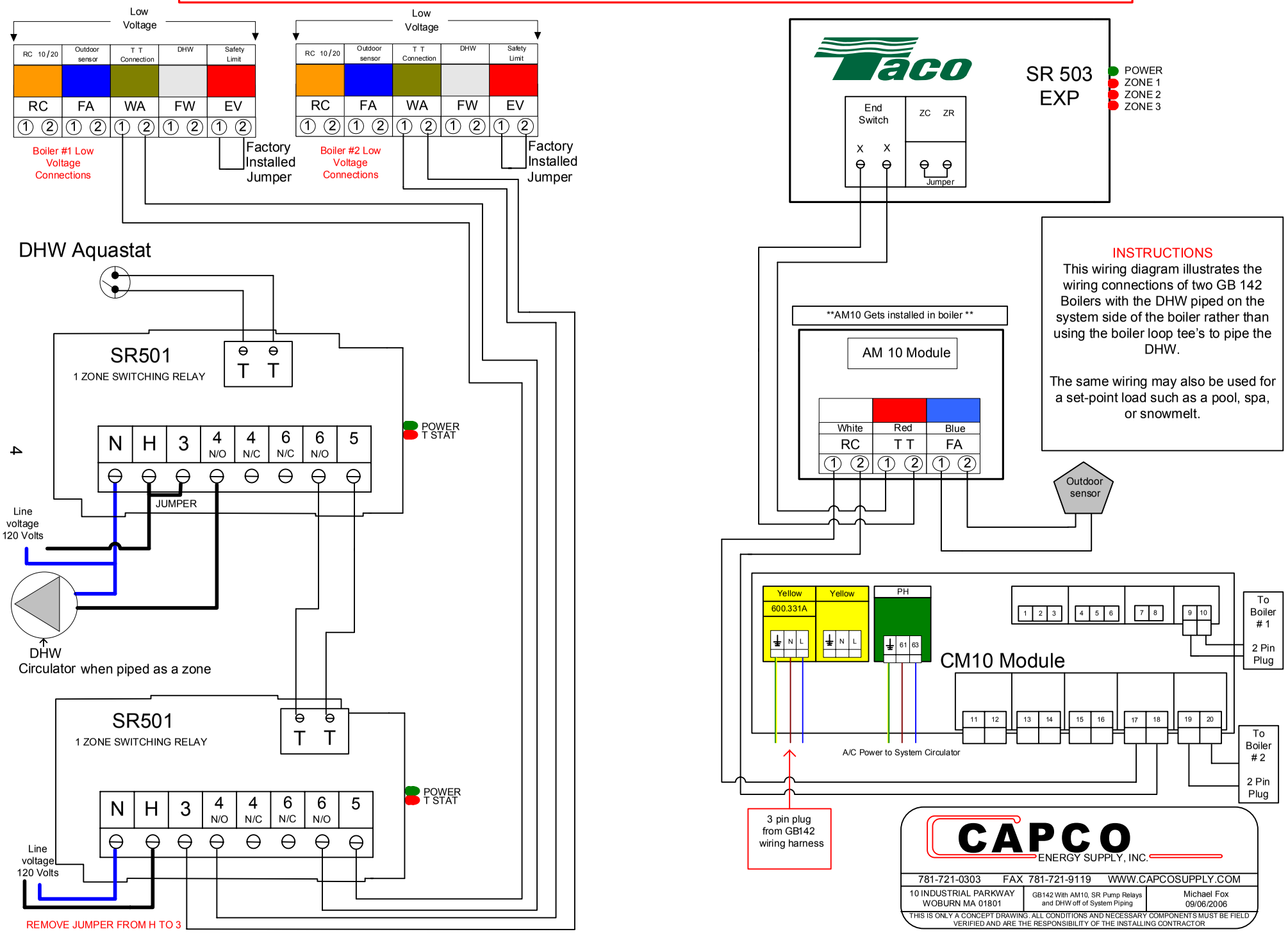
TWO GB 142 Wiring with DHW on System Side of a Hydro Separator


Low Voltage
RC 10/20
Outdoor sensor
T T Connection
DHW
Safety Limit
RC
FA
WA
FW
EV
Boiler #1 Low Voltage Connections
Factory Installed Jumper
Boiler #2 Low Voltage Connections
Factory Installed Jumper
DHW Aquastat
SR501
1 ZONE SWITCHING RELAY
T T
N H 3 4 N/O 4 N/C 6 N/C 6 N/O 5
POWER T STAT
JUMPER
Line voltage 120 Volts
DHW Circulator when piped as a zone
SR501
1 ZONE SWITCHING RELAY
T T
N H 3 4 N/O 4 N/C 6 N/C 6 N/O 5
POWER T STAT
Line voltage 120 Volts
REMOVE JUMPER FROM H TO 3
Taco
SR 503 EXP
POWER
ZONE 1
ZONE 2
ZONE 3
End Switch
X X
ZC ZR
Jumper
**AM10 Gets installed in boiler **
AM 10 Module
White Red Blue
RC T T FA
Outdoor sensor
INSTRUCTIONS
This wiring diagram illustrates the wiring connections of two GB 142 Boilers with the DHW piped on the system side of the boiler rather than using the boiler loop tee's to pipe the DHW.
The same wiring may also be used for a set-point load such as a pool, spa, or snowmelt.
Yellow
600.331A
Yellow
PH
CM10 Module
A/C Power to System Circulator
To Boiler # 1
2 Pin Plug
To Boiler # 2
2 Pin Plug
3 pin plug from GB142 wiring harness
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GB142 With AM10, SR Pump Relays and DHW off of System Piping
Michael Fox 09/06/2006
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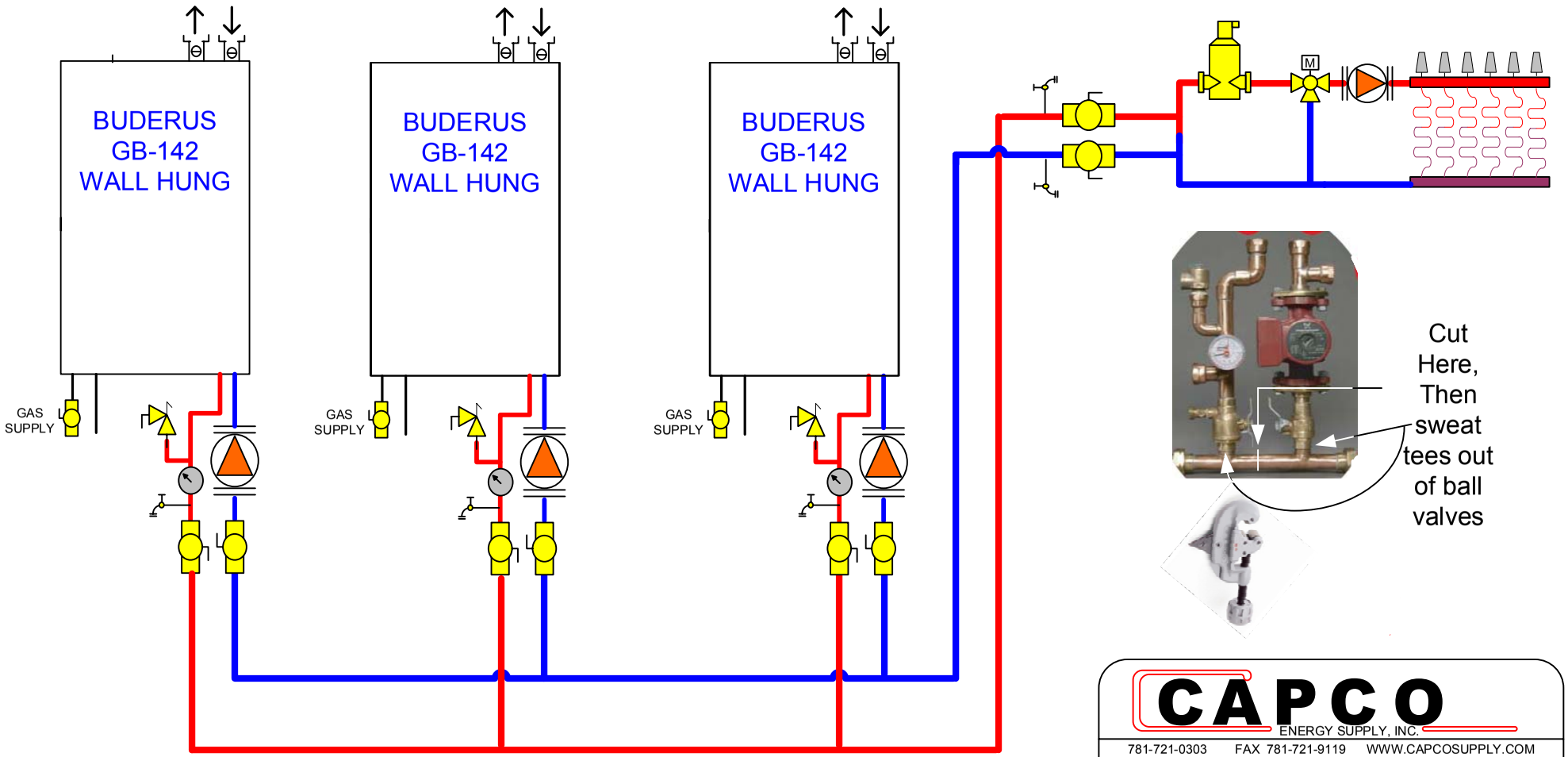
Control options are many and are application specific. One possibility is a Tekmar 265 modulating boiler control with each boiler having an EM10 module. For other control options please call and speak to us about the application. We will help in any way we can and have many previous applications to refer to. Call Capco @781-721-0303.



Pipe size increases from left to right

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GB 142's with Manifold cut

Michael D. Fox
02/02/2007

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Single Boiler Control

Controlling a single boiler using a building monitoring system or external controller that provides a modulating 0-10Vdc or 0-20mA heat demand.

Sample installations

Tekmar 263, or tN4 Control w/ EM10 (See Tekmar documentation for details on device)

Piping diagram:

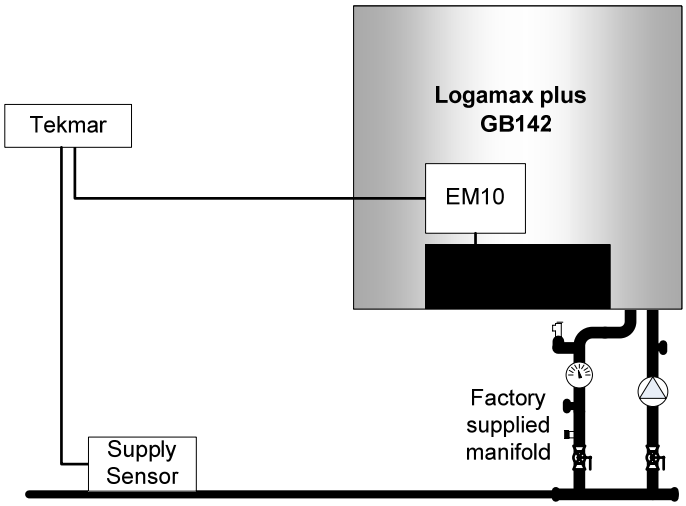


Figure 3

Wiring diagram:
Example Tekmar 263

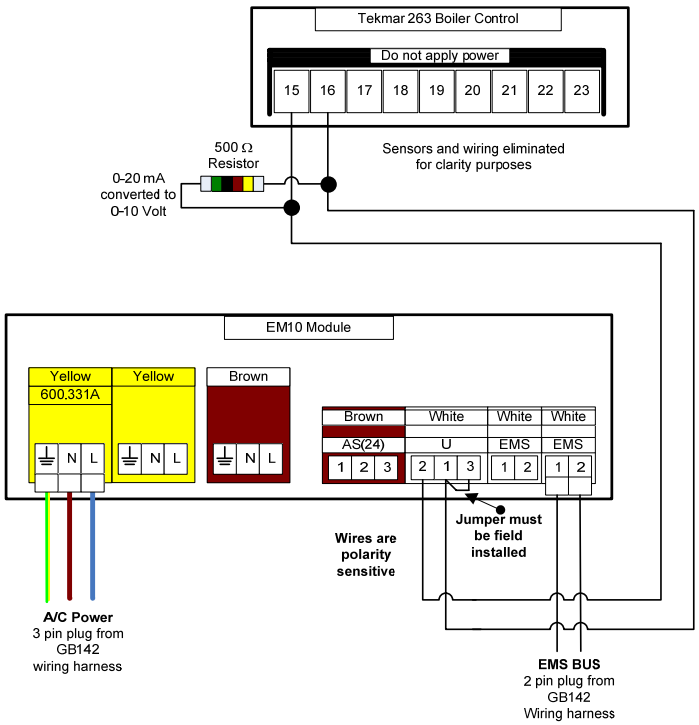


Figure 4

Scenario 2: Controlling 2 boilers using a 0-10Vdc or 0-20mA output from a building monitoring system or external controller:

Solution: 2 GB142 boilers with 2 EM10 modules
Example: Tekmar 265 or Tekmar tN4

NOTICE:
DHW controlled by the Buderus boiler is preferred.*

NOTICE:
Use this setup when controlling both boilers in parallel, with both boilers simultaneously firing at the same rate.

Piping diagram:

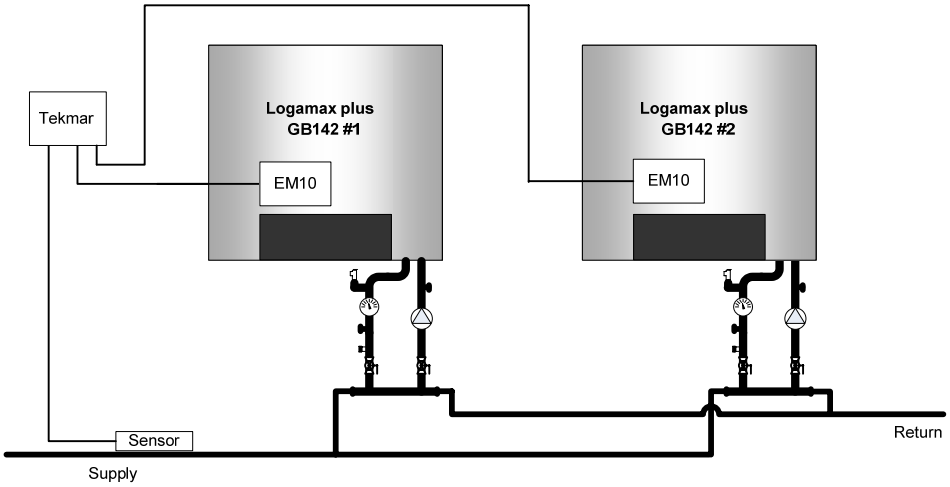


Figure 5

Wiring Diagram

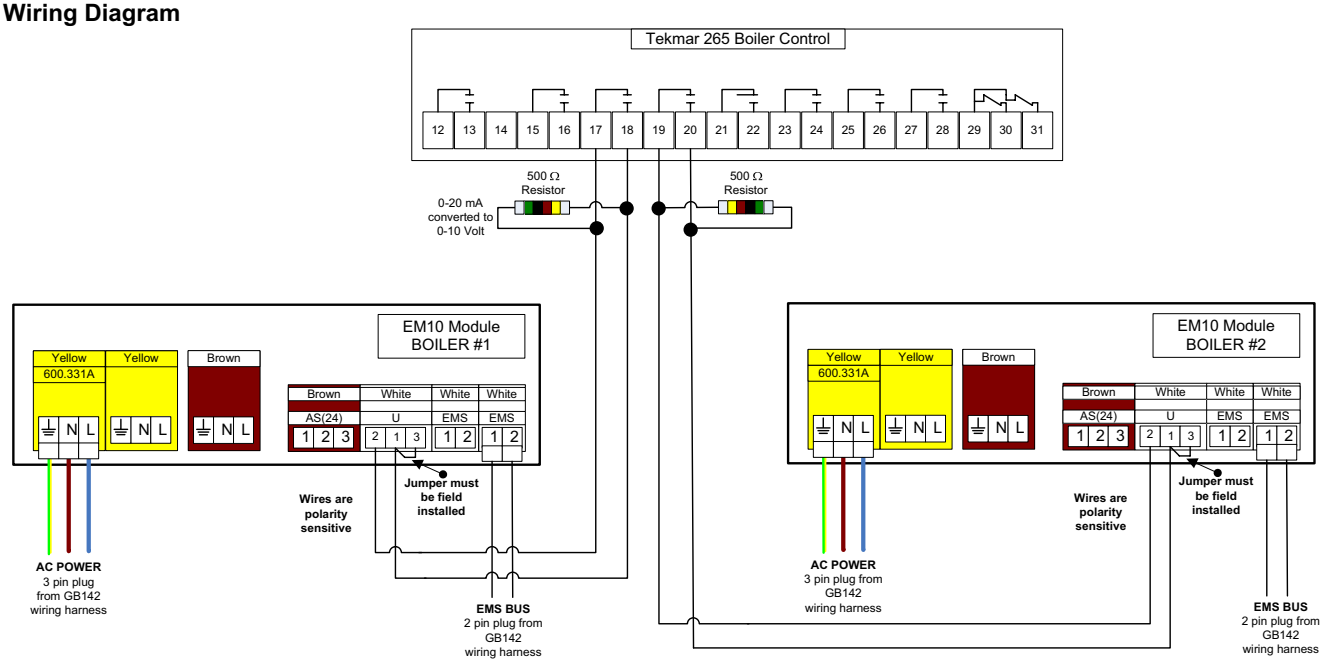


Figure 6

Multiple Boiler Control

3 Boilers

Scenario 1: Tekmar 265 or Tekmar tN4 w/ 3 EM10 modules and no DHW Tekmar
(See Tekmar Documentation for details)

Piping diagram:

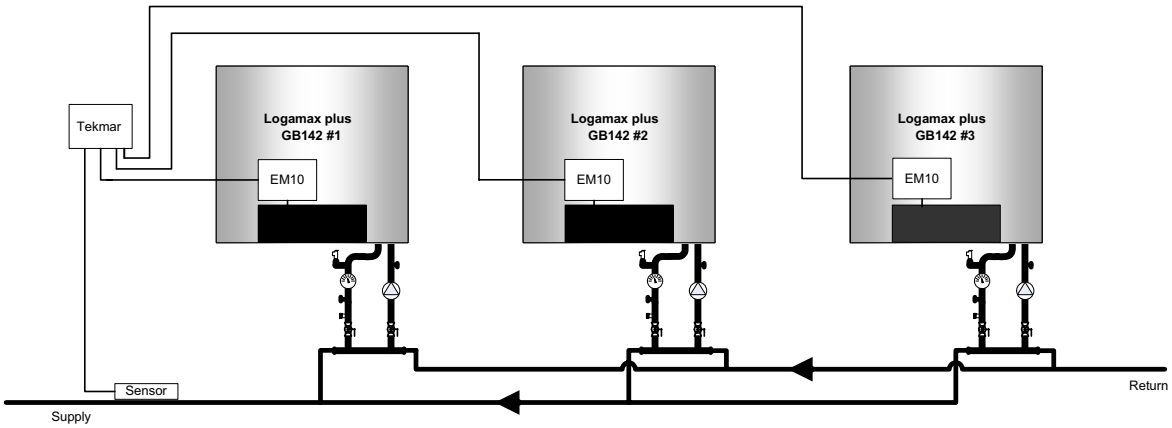


Figure 7

Wiring diagram:

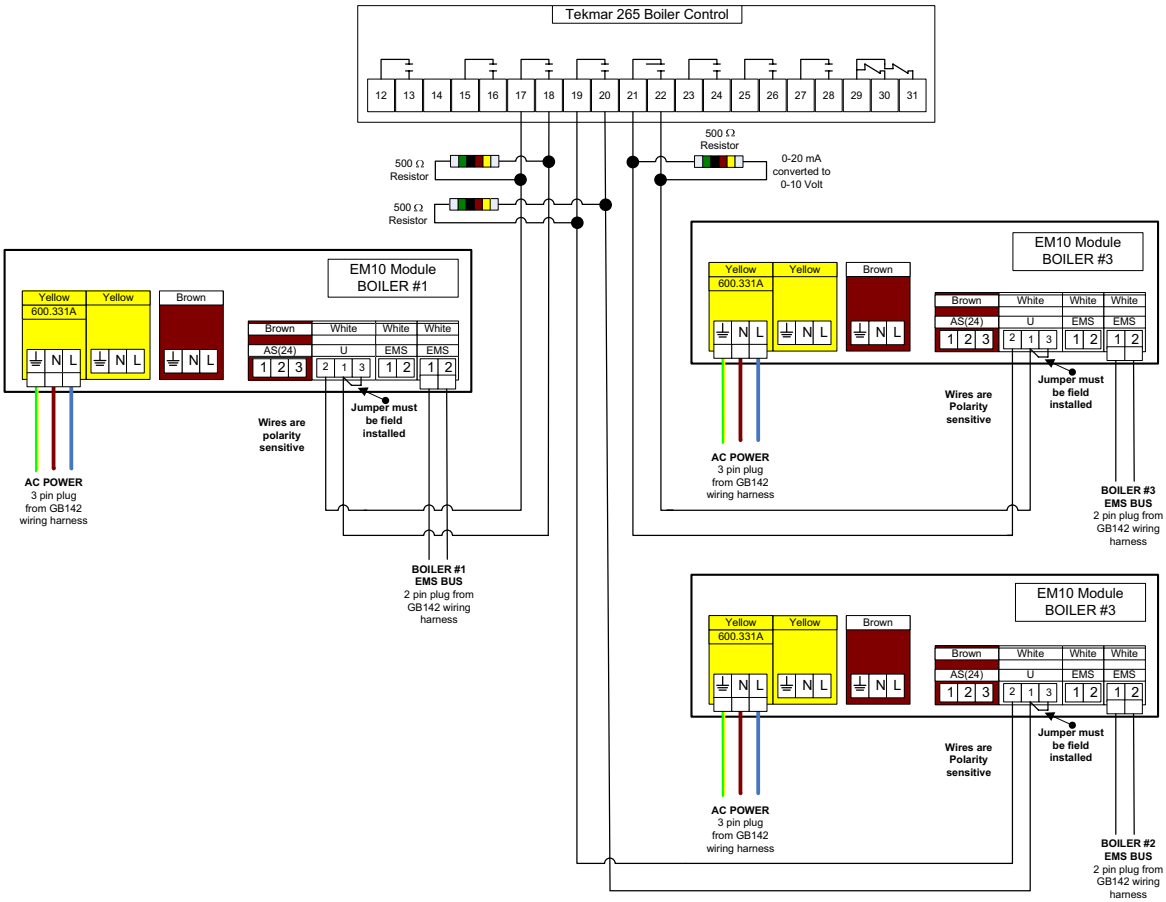
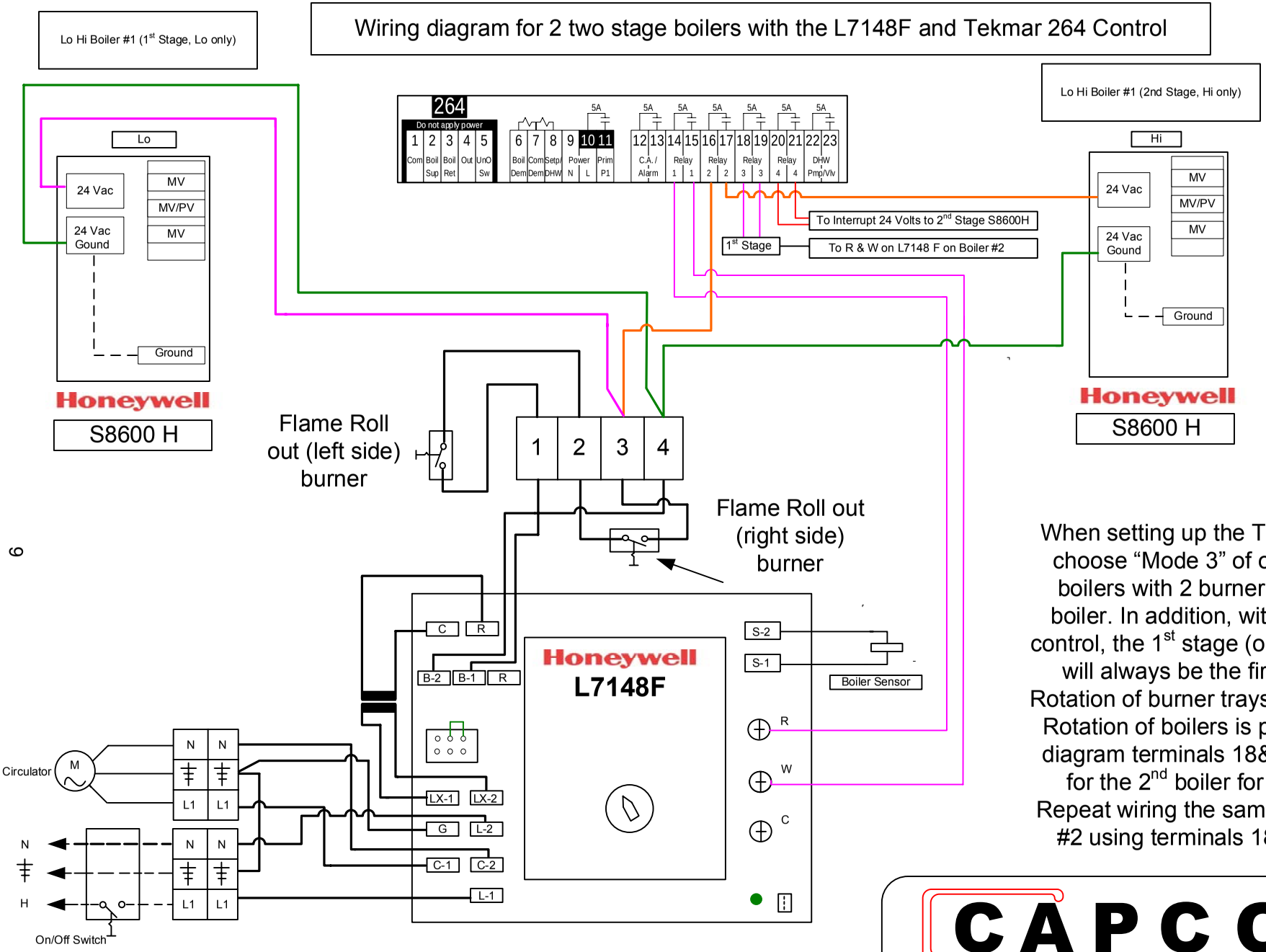


Figure 8

Wiring diagram for 2 two stage boilers with the L7148F and Tekmar 264 Control



When setting up the TK264 you must choose “Mode 3” of operation for 2 boilers with 2 burner trays in each boiler. In addition, with the L7148 F control, the 1st stage (or 1st burner tray) will always be the first to light off. Rotation of burner trays is not possible. Rotation of boilers is possible. In this diagram terminals 18&19, 20&21 are for the 2nd boiler for stage 1 & 2. Repeat wiring the same way on Boiler #2 using terminals 18&19, 20&21.

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2 Buderus
G334X with Tekmar 264

Michael Fox
02/01/2007

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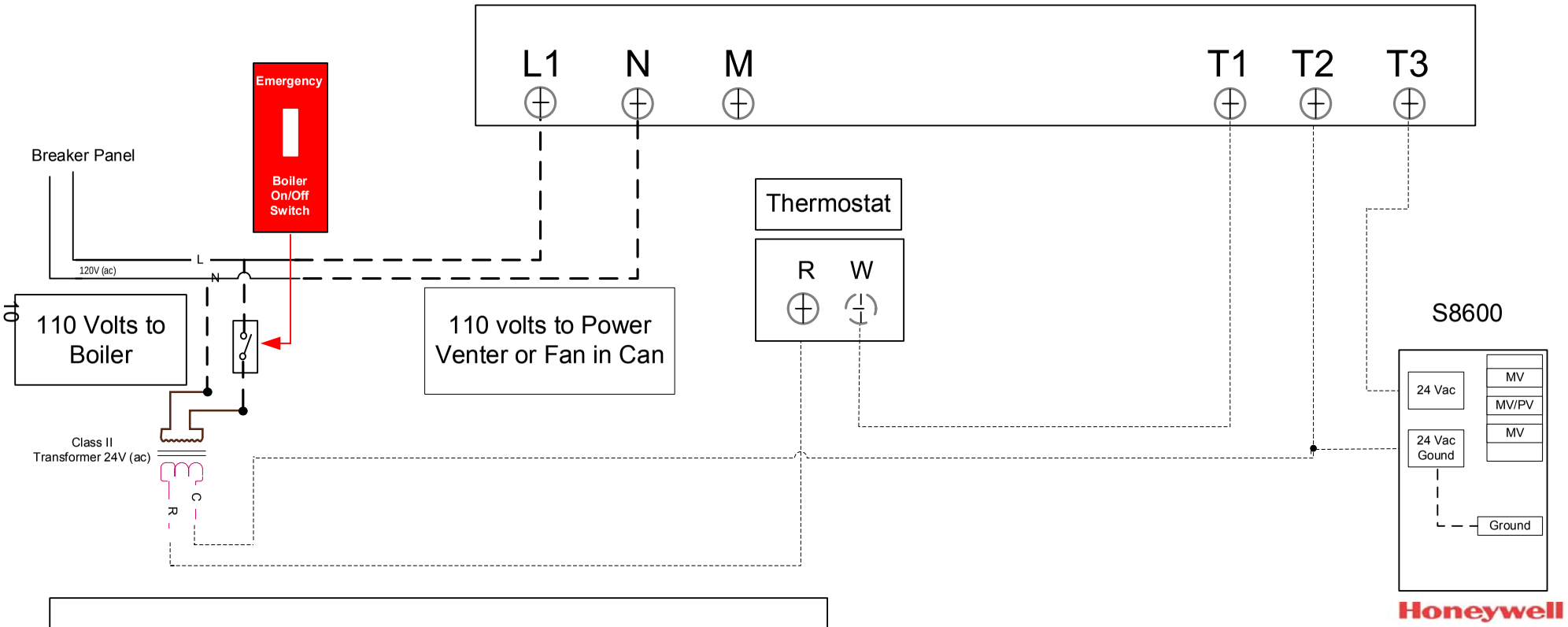
Wiring for Power Venters or Combustion air fans

installer wiring

Terminal Block in unit



Terminal T2 needs a common leg from a 24 volt transformer in order to energize the coil in the control unit. Therefore, in the boiler you are wiring, you must seek out the common side of the 24 volt transformer. This is the transformer that will be powering the ignition module for the gas valve as well as any other 24 volt devices.

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Field CAS Wiring

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SR 501 Wiring Match Up

SR501
1 ZONE
SWITCHING
RELAY

⊖	⊖	⊖
R	W	24 VAC
T	T	COM

TACO

POWER
T STAT

120 VAC
INPUT

N	H	3	4 N/O	4 N/C	6 N/C	6 N/O	5
⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖

Class II
Transformer 24V (ac)

C
R
L
N

120V (ac)

To Mix Demand

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SR 501 Match Up

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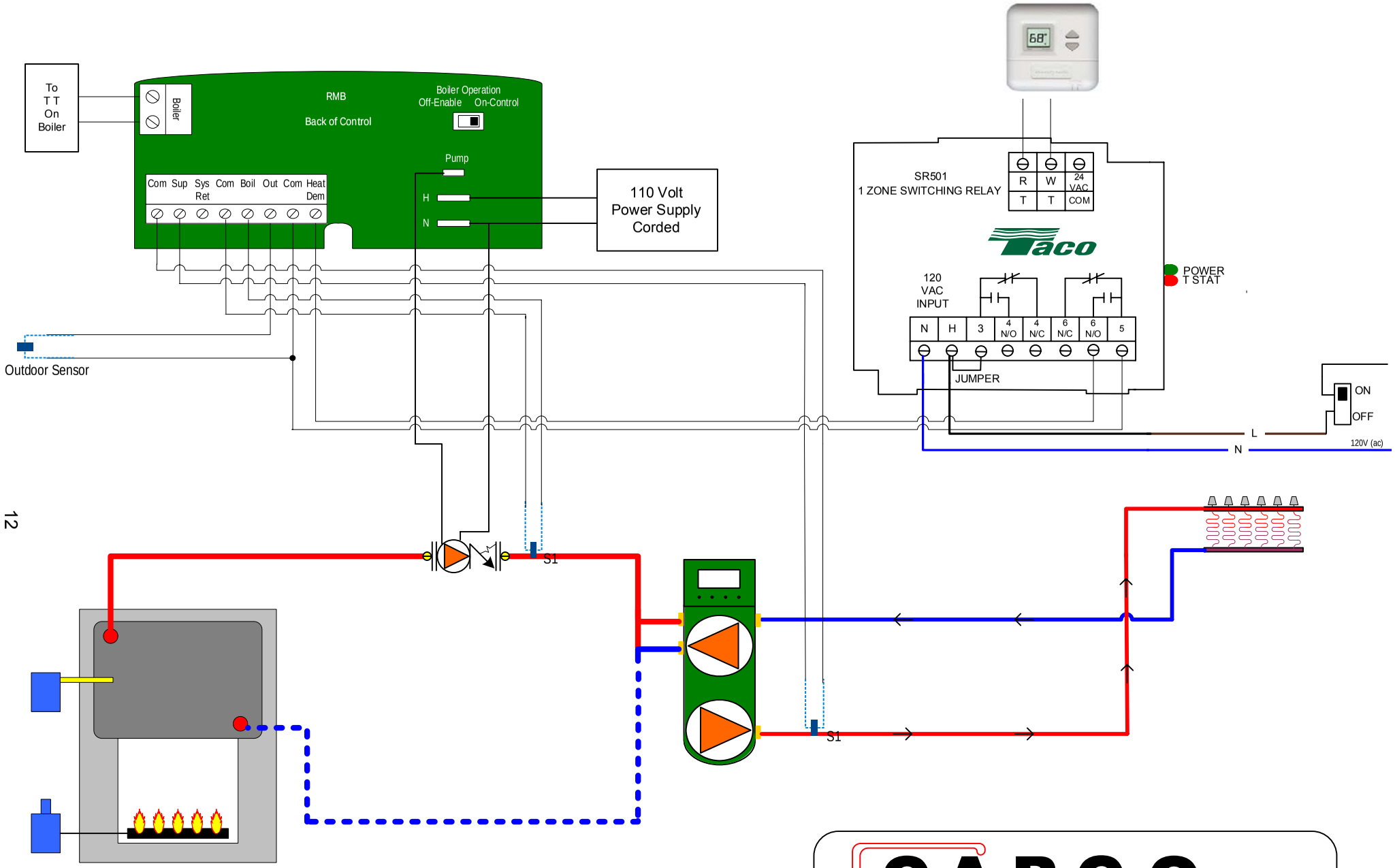

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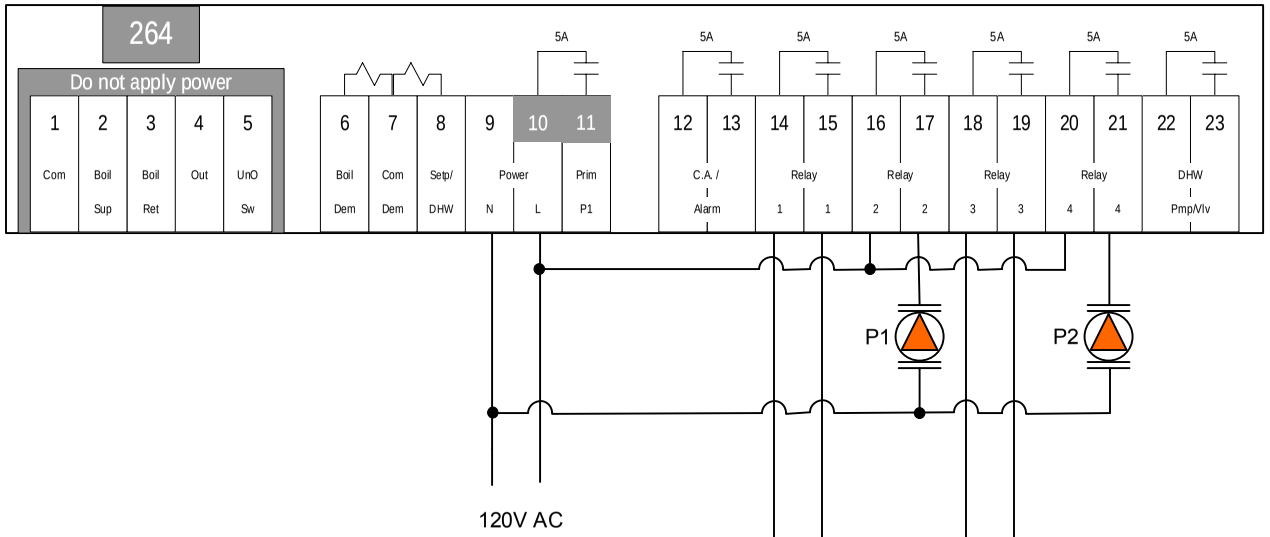
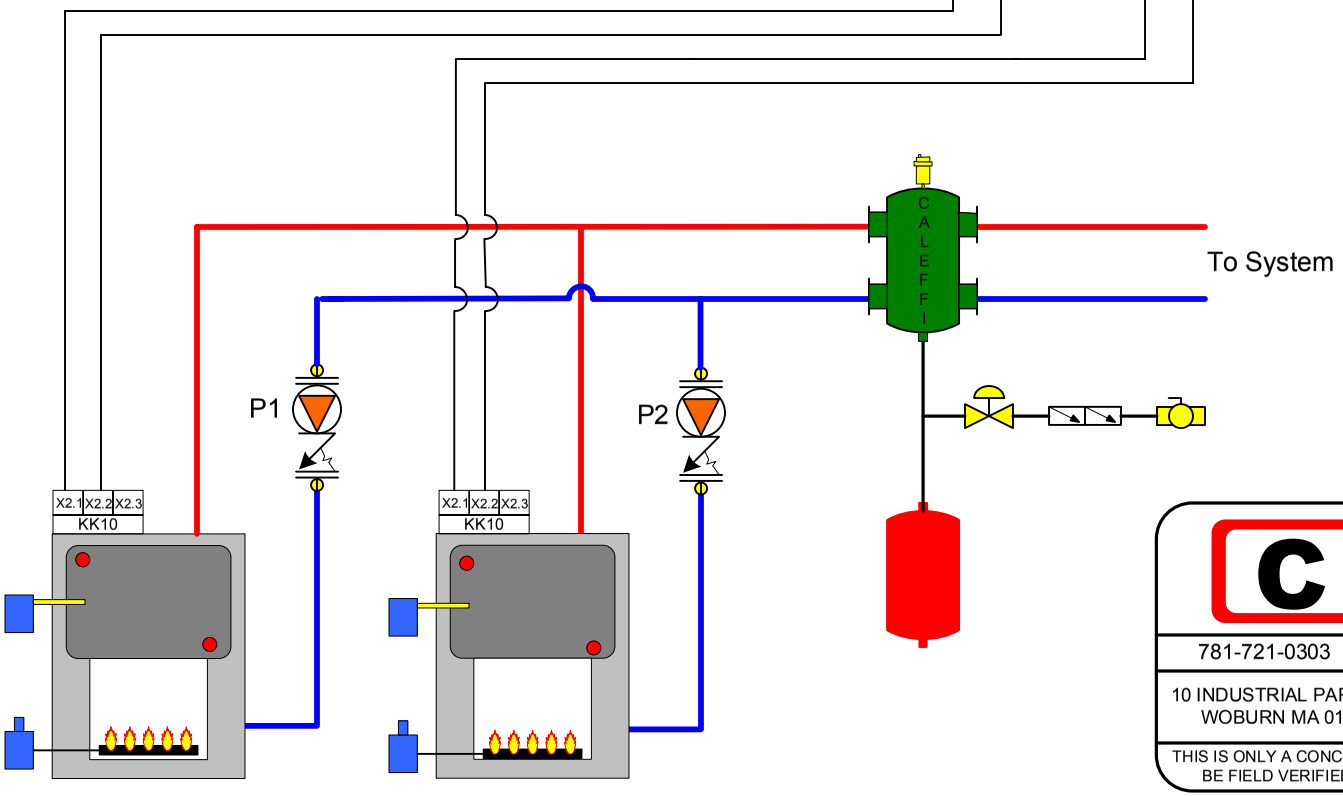
Tekmar 264 Control with Caleffi





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TEKMAR 264 WITH CALEFFI

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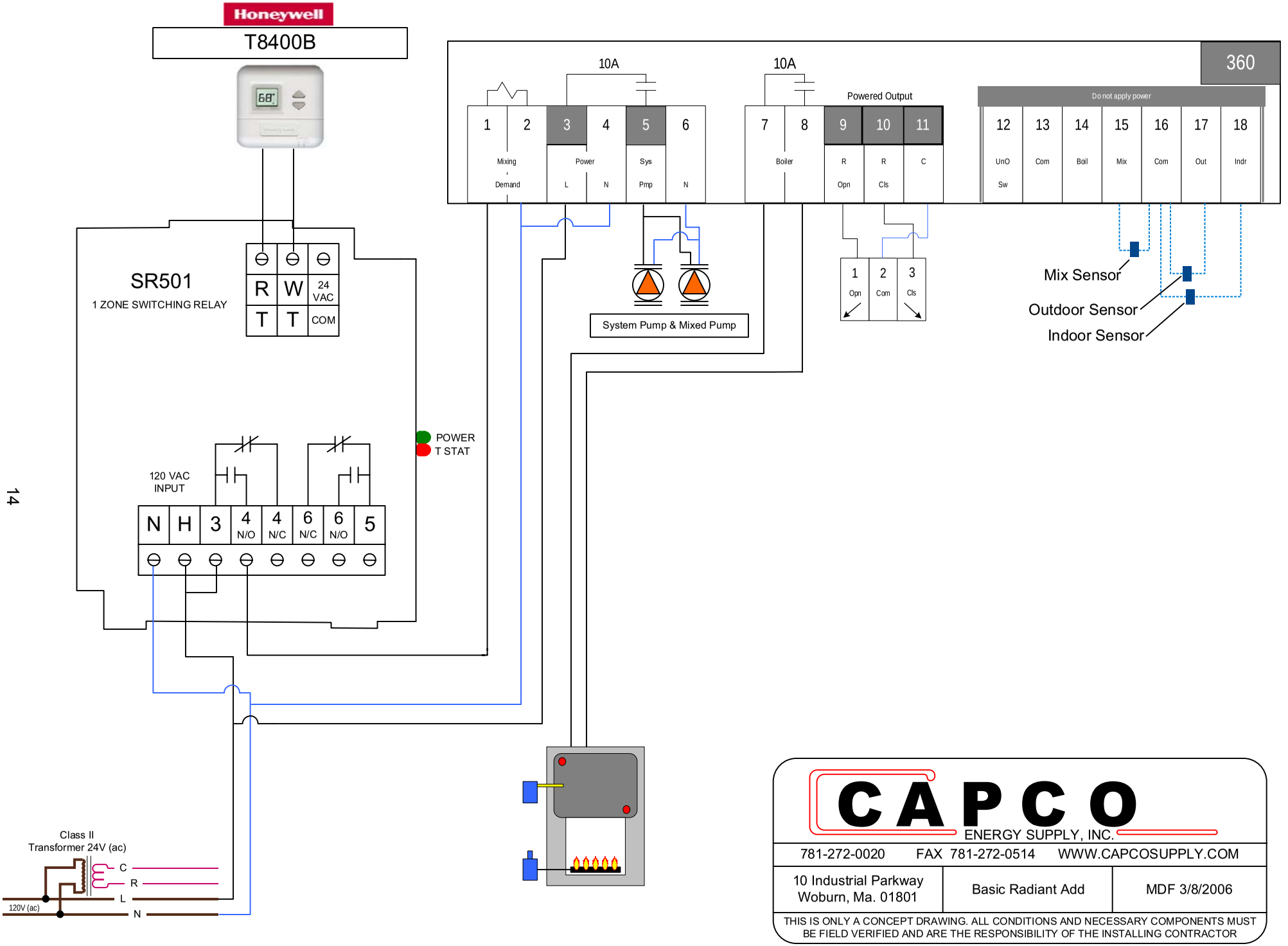

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Basic Radiant Add

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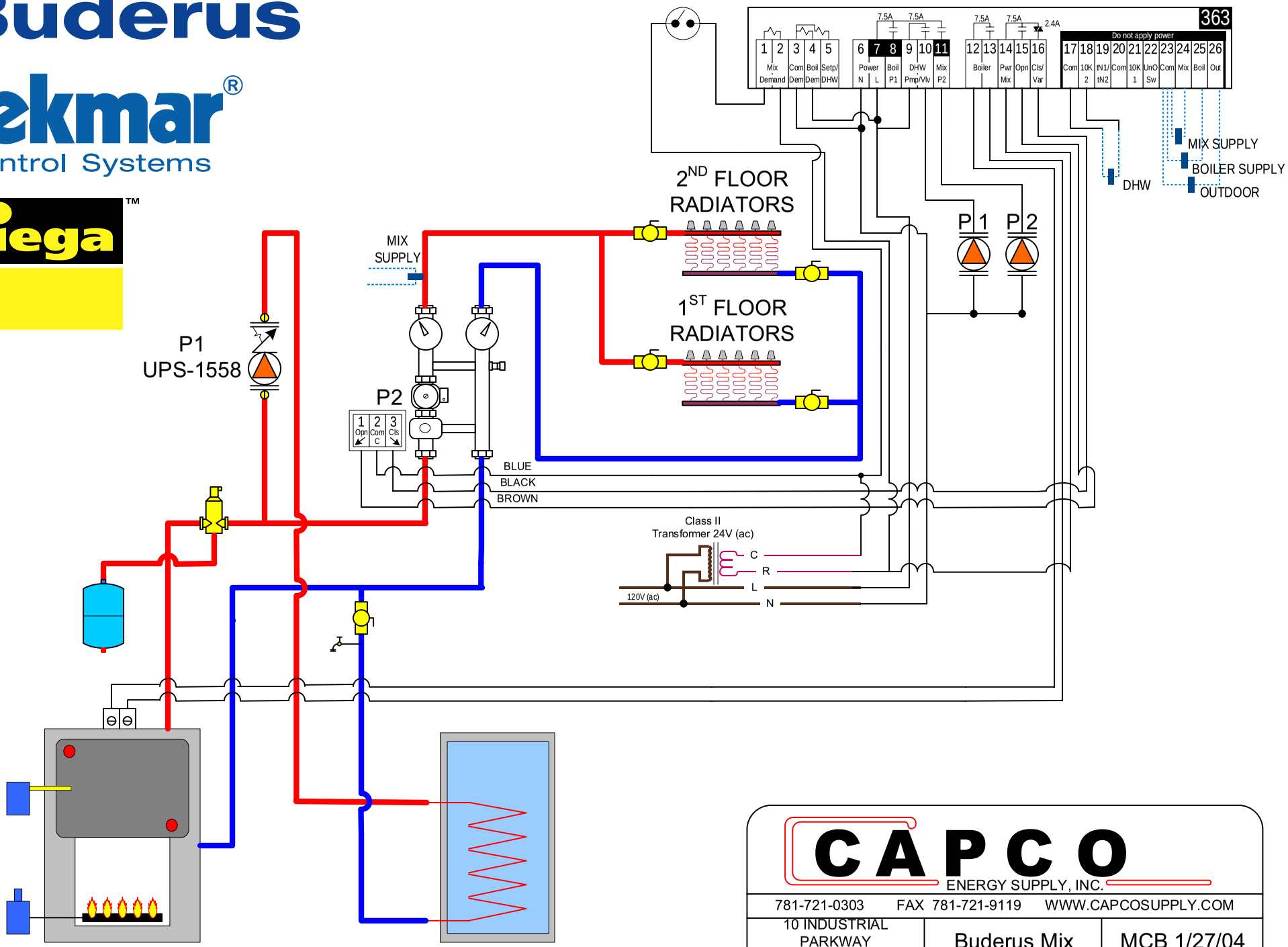
Buderus

tekmar®
Control Systems

Viega™



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Buderus Mix

MCB 1/27/04

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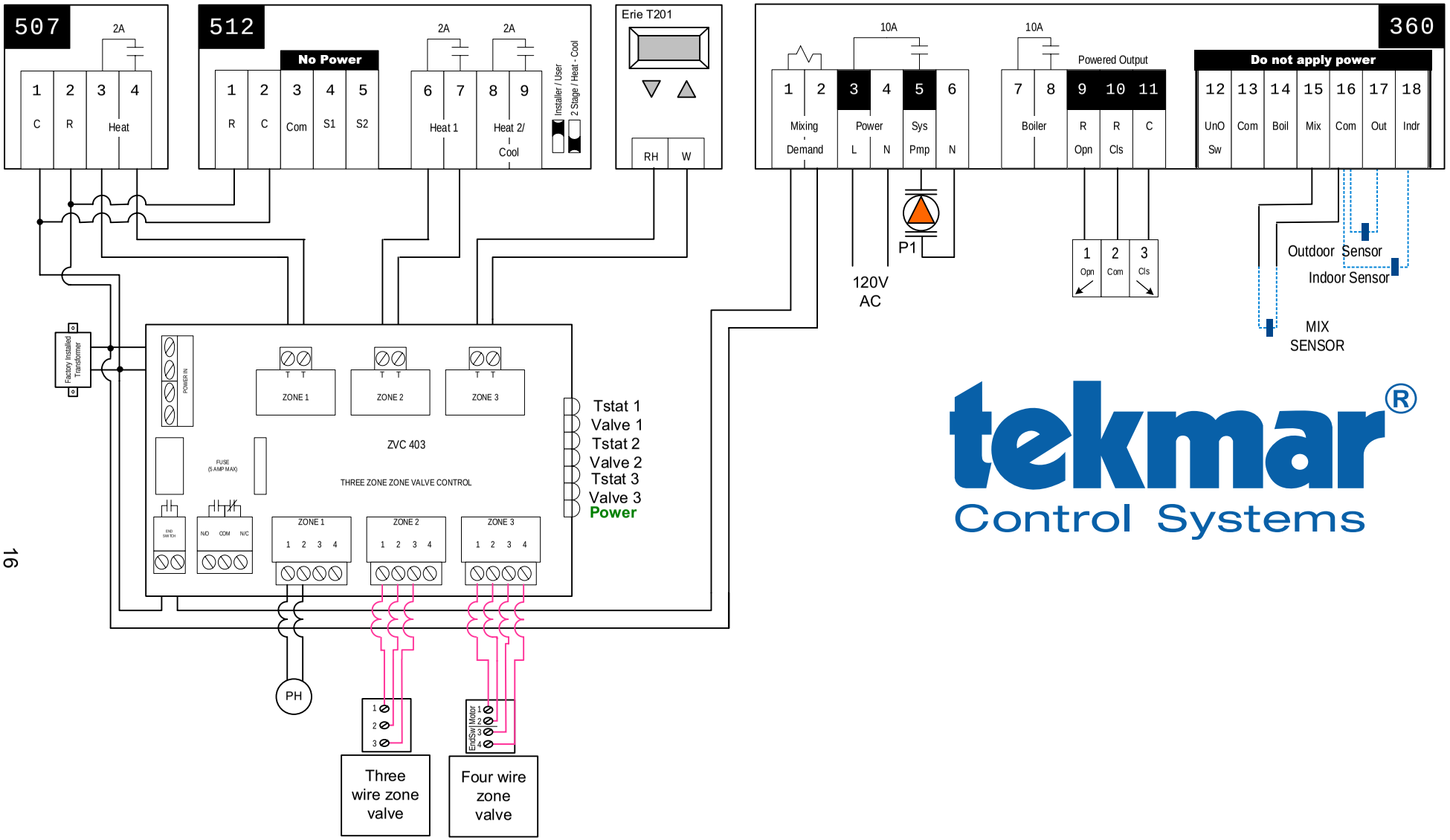

tekmar®
Control Systems

Taco

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360 WITH SR503 AND STATS

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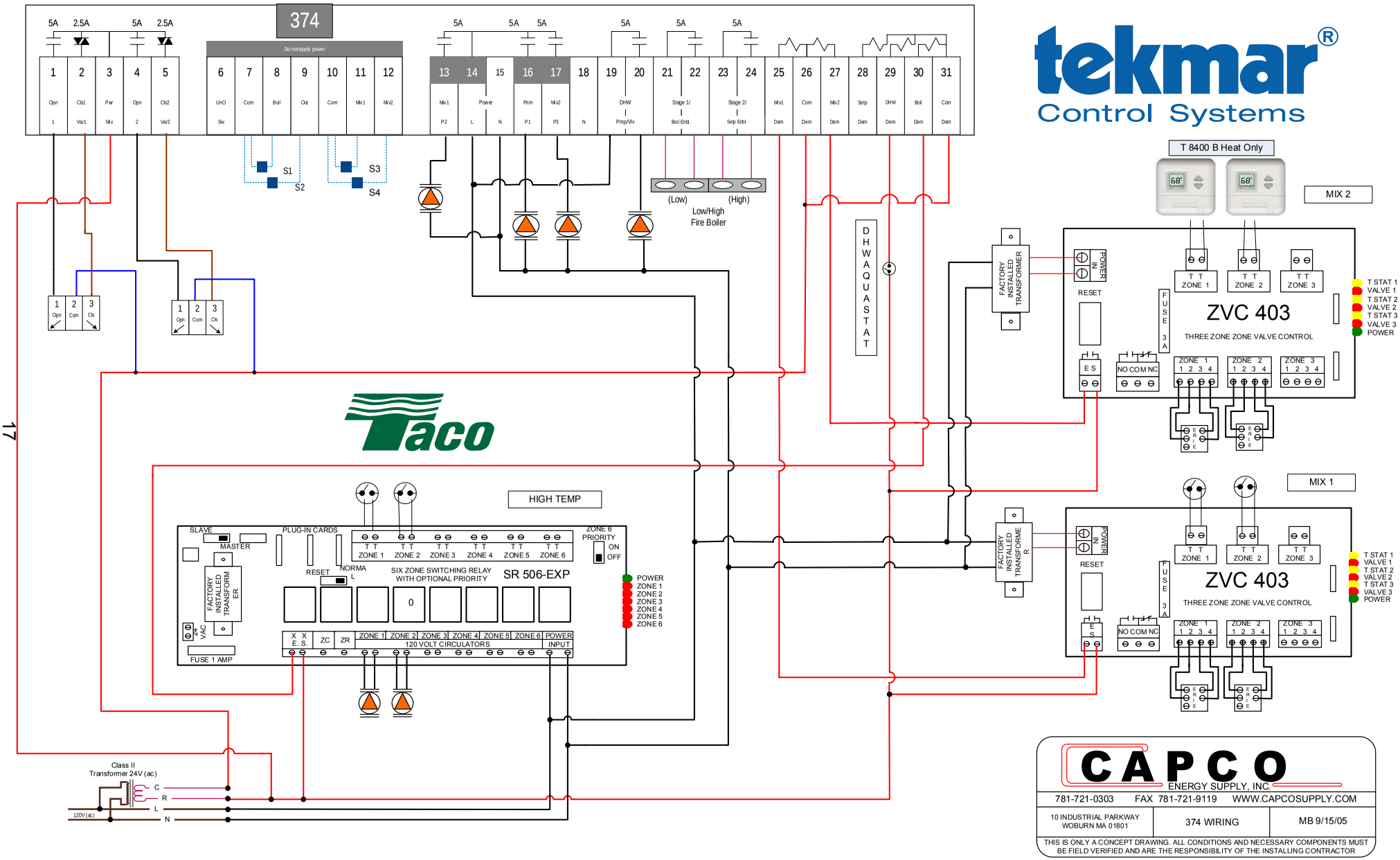

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374 WIRING

MB 9/15/05

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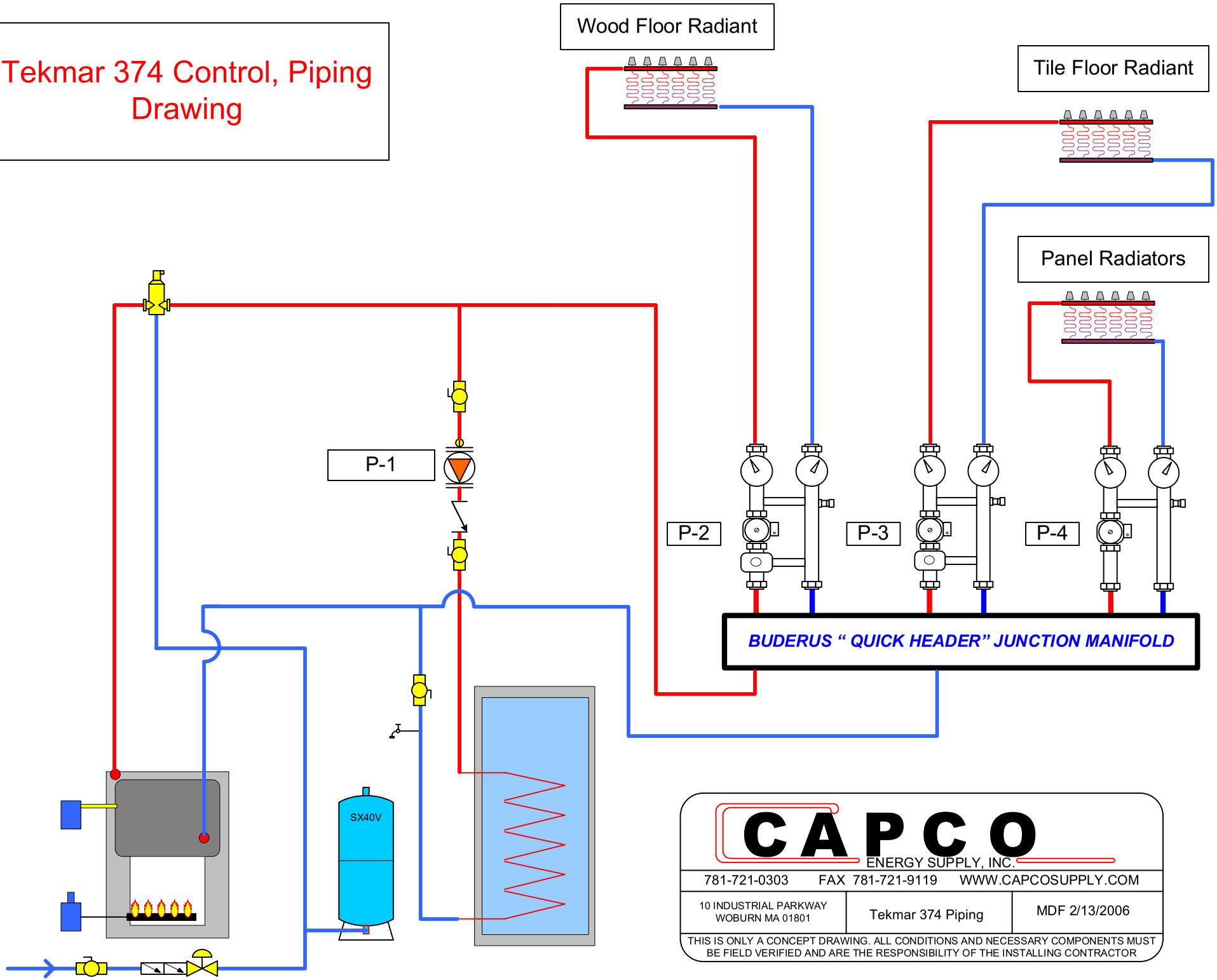
Tekmar 374 Control, Piping Drawing



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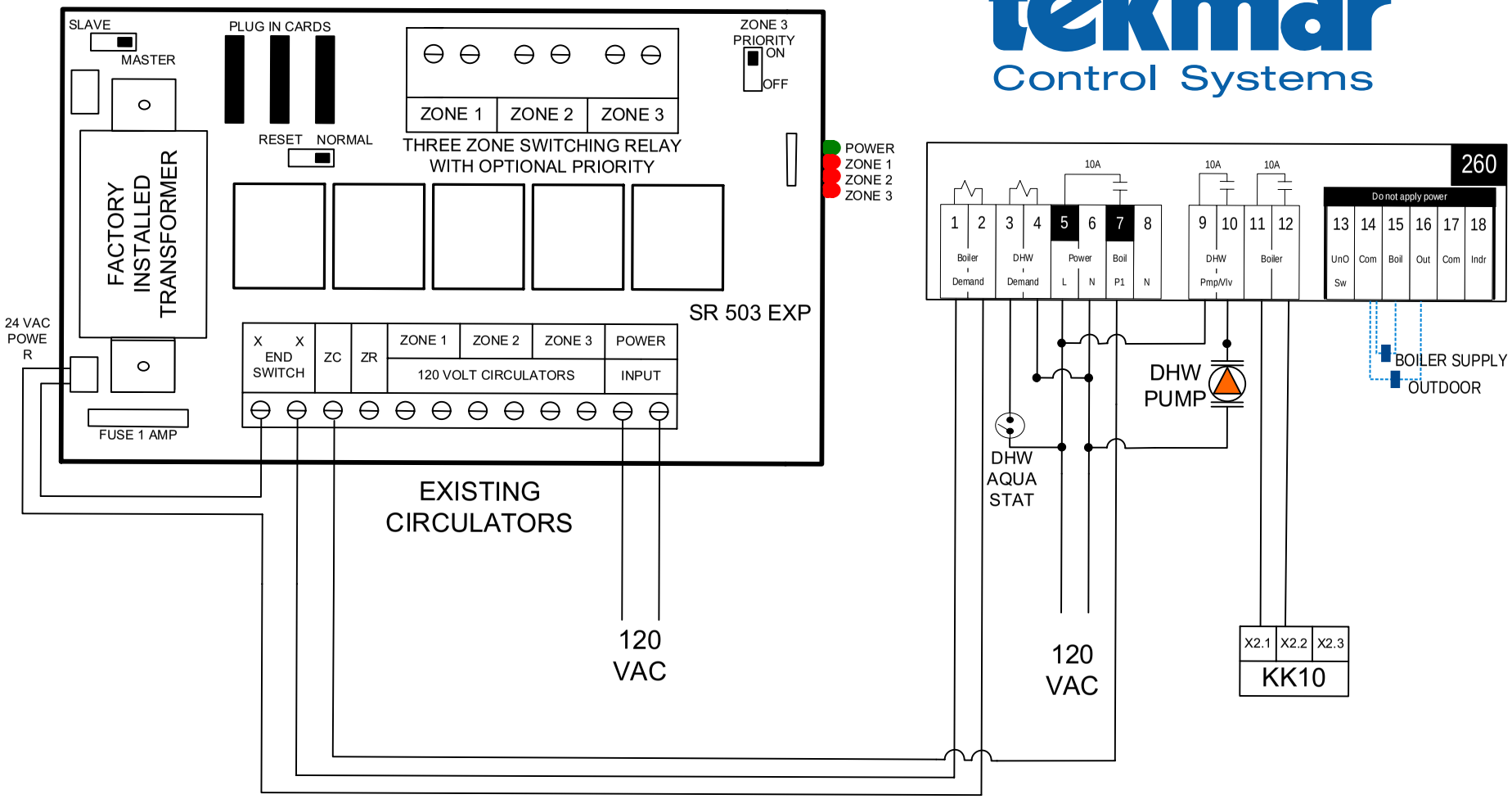

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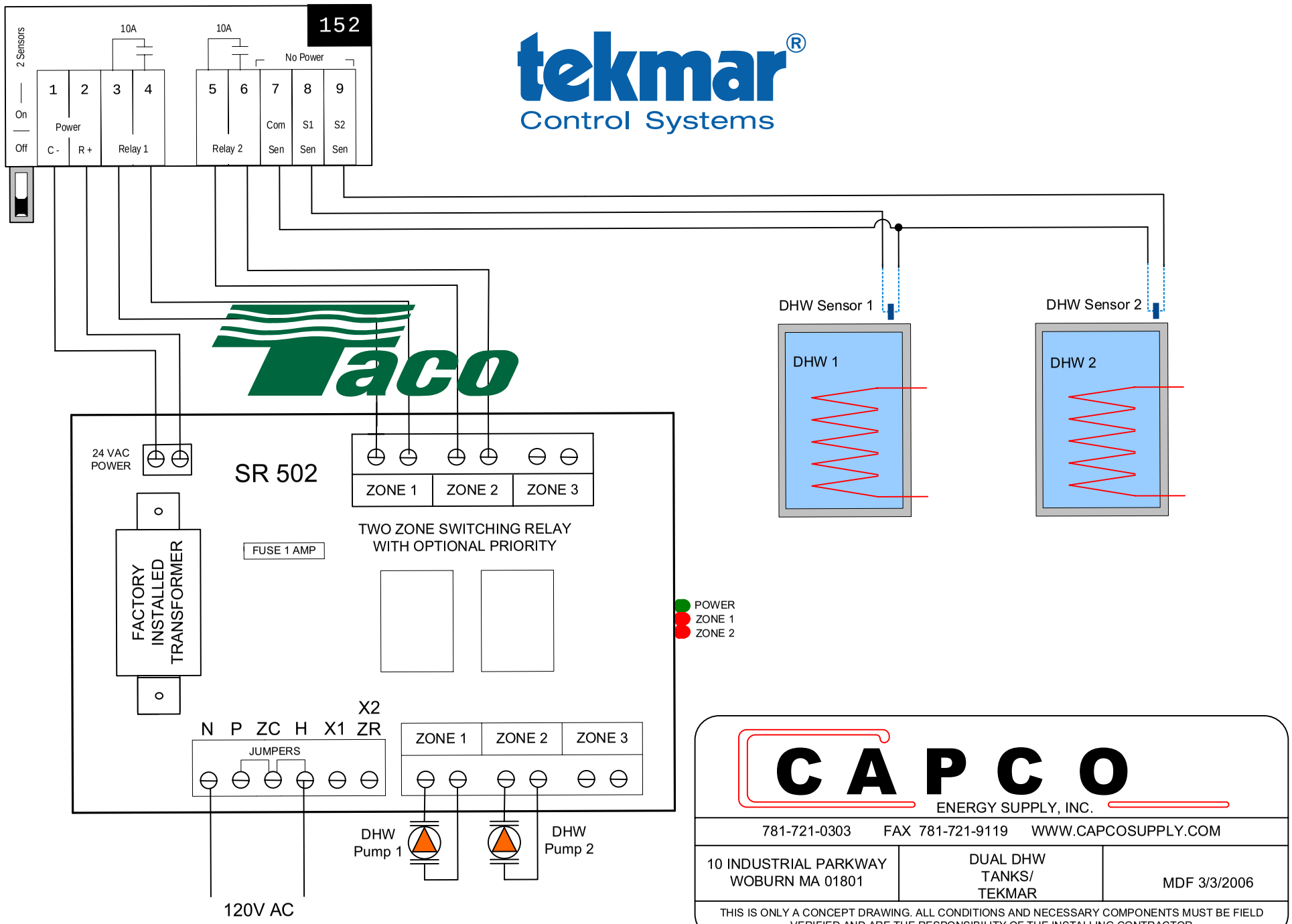

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DUAL DHW
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TEKMAR

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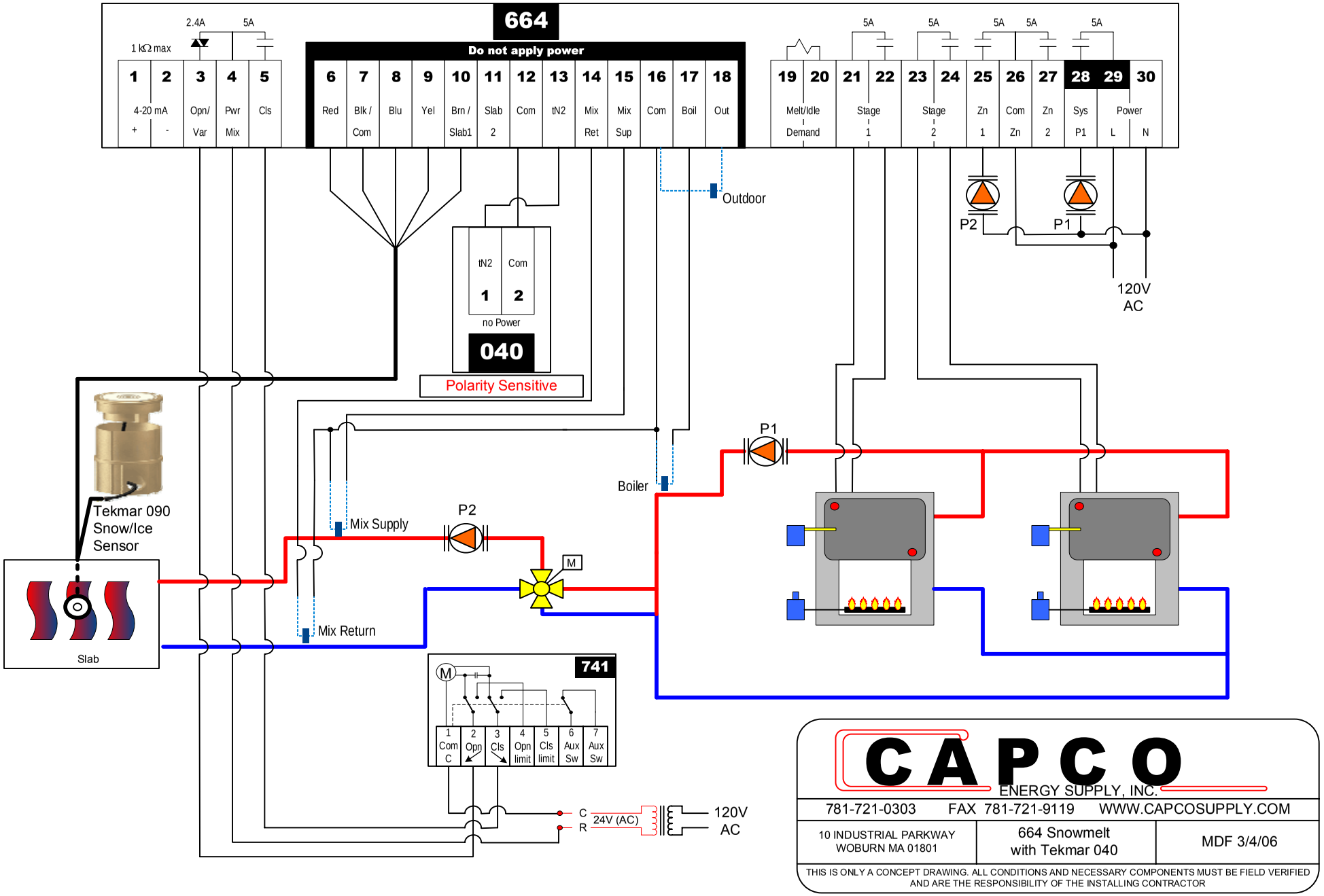

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664 Snowmelt
with Tekmar 040

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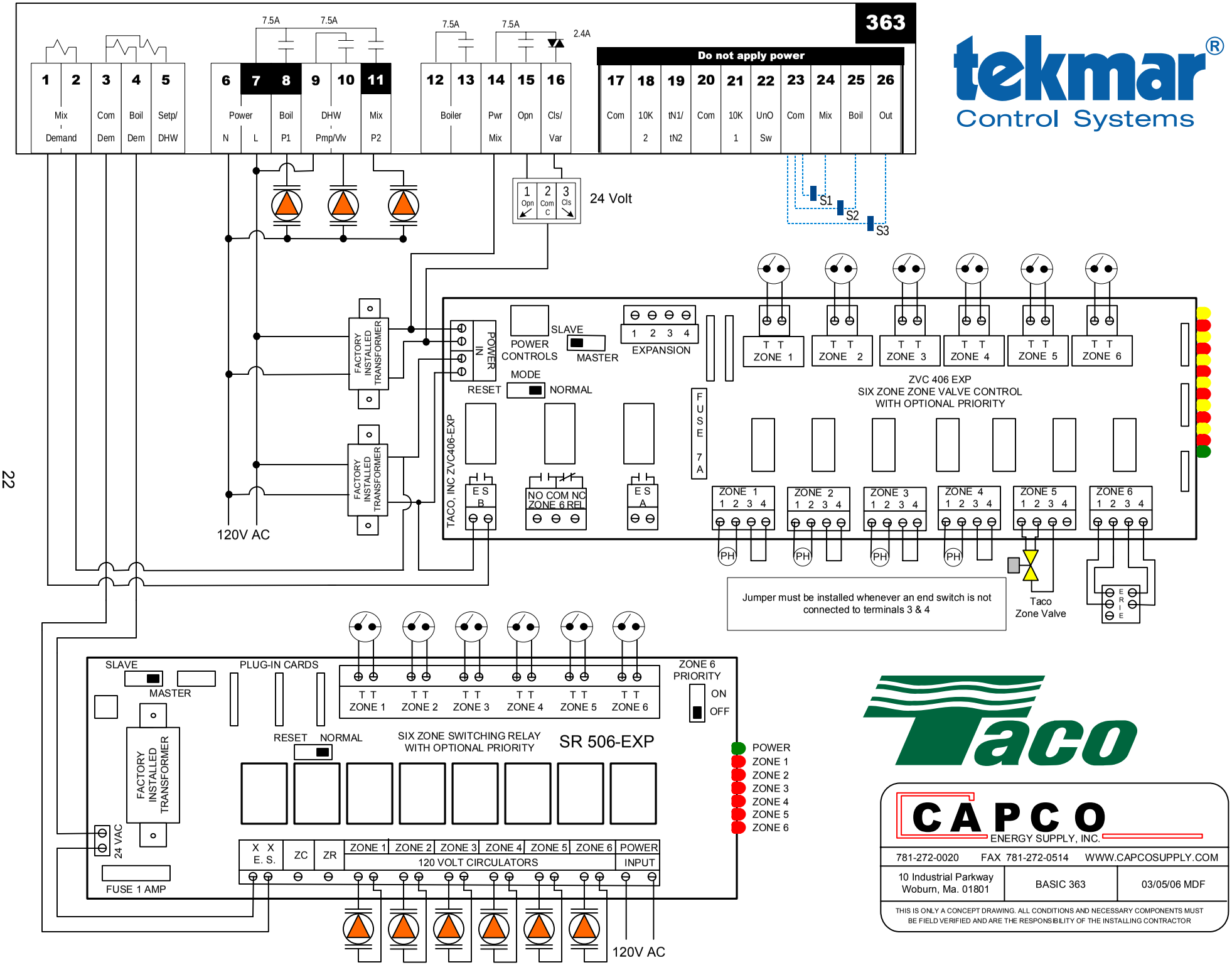

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BASIC 363

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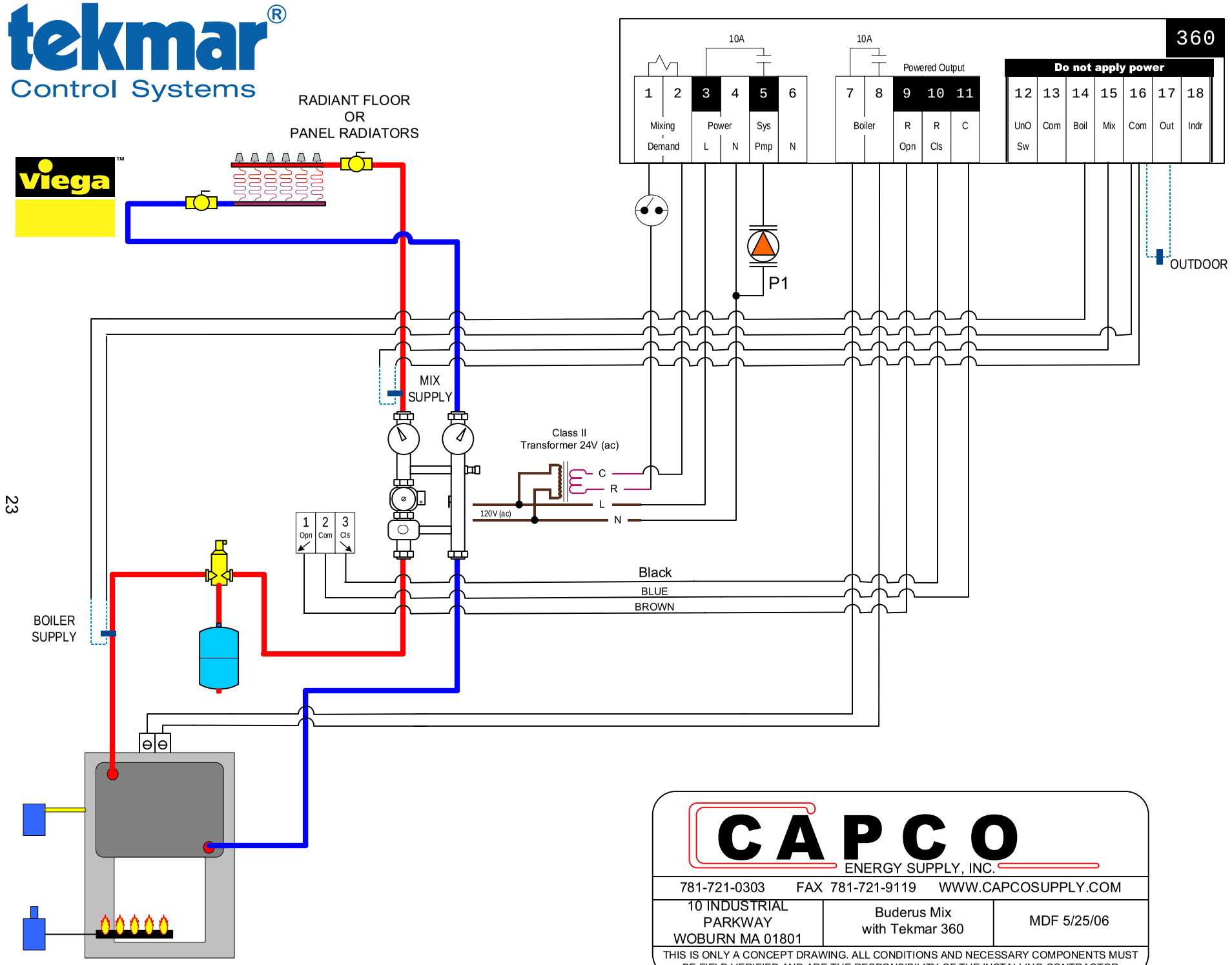

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Buderus Mix with Tekmar 360

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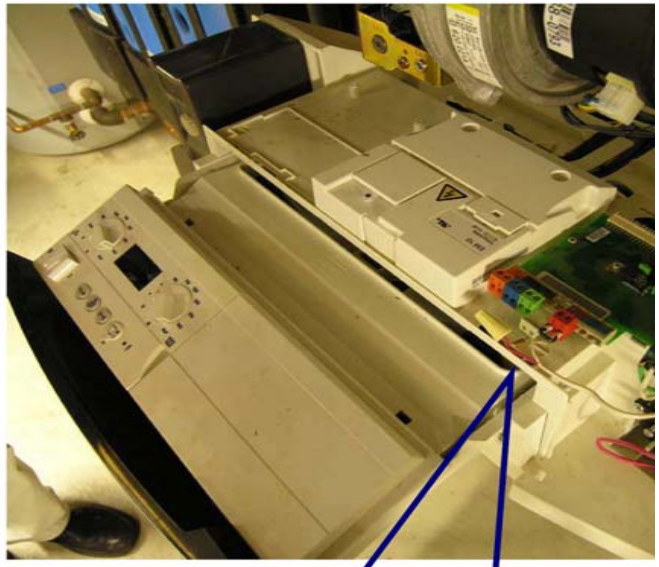
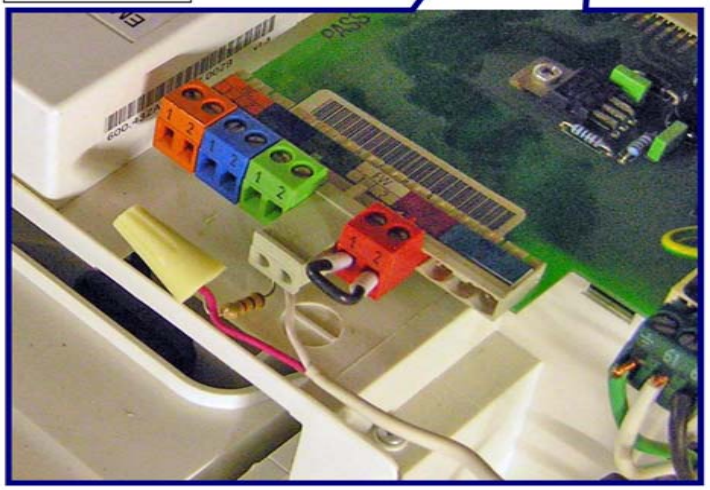
TURBOMAX

TurboMax tank with Buderus GB142 boiler being used in conjunction with the prepiped manifold and the Buderus DHW sensor in the turbomax tank. To achieve 180 F, in the tank (boiler water temperature) and have the full performance of the tank, the installer/electrician must install a 1000 ohm or 1K ohm resistor in series with the sensor. See the photos to the right.



Closer view



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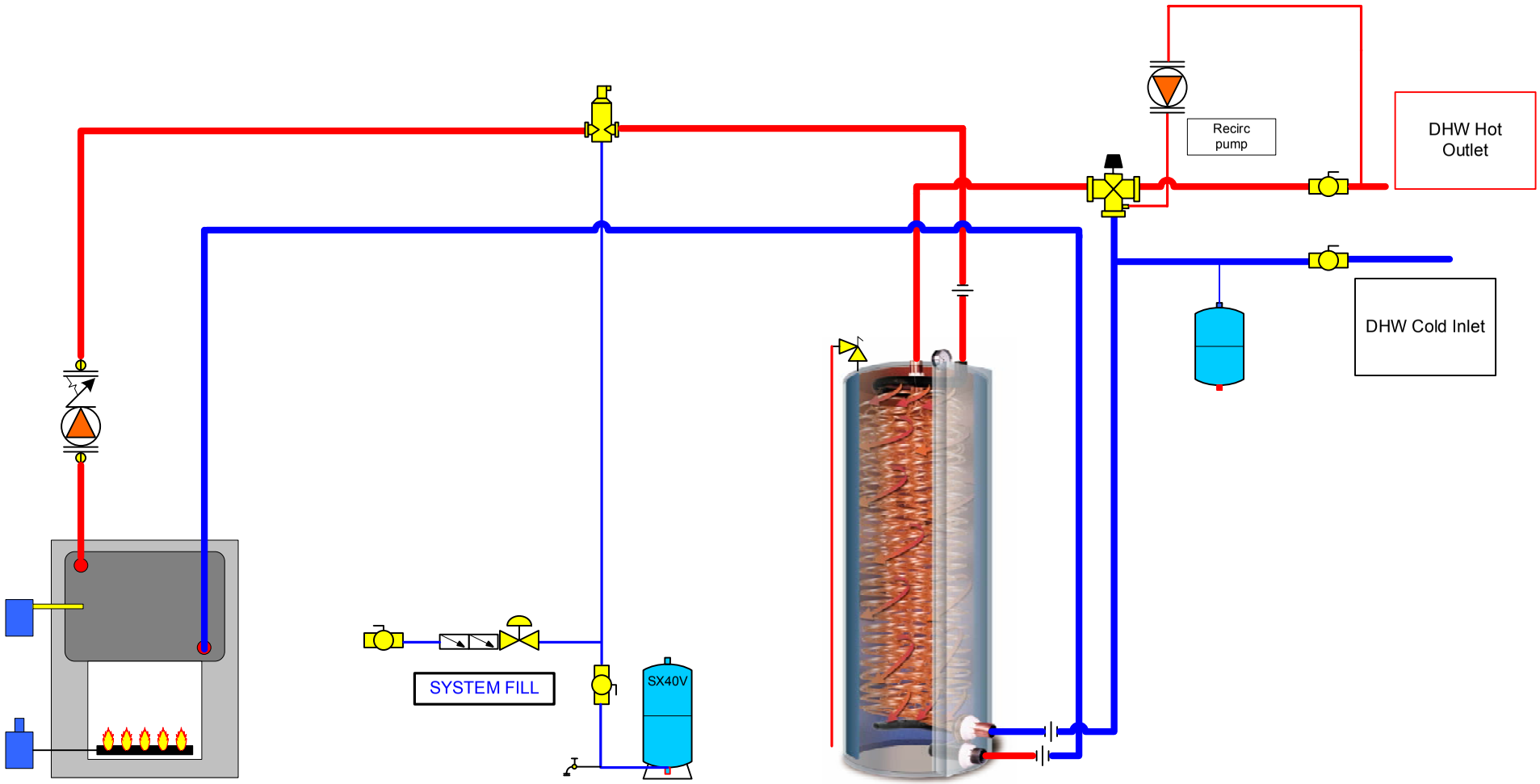
TURBOMAX Typical Piping



TURBOMAX

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Turbomax
Typical Tank Piping

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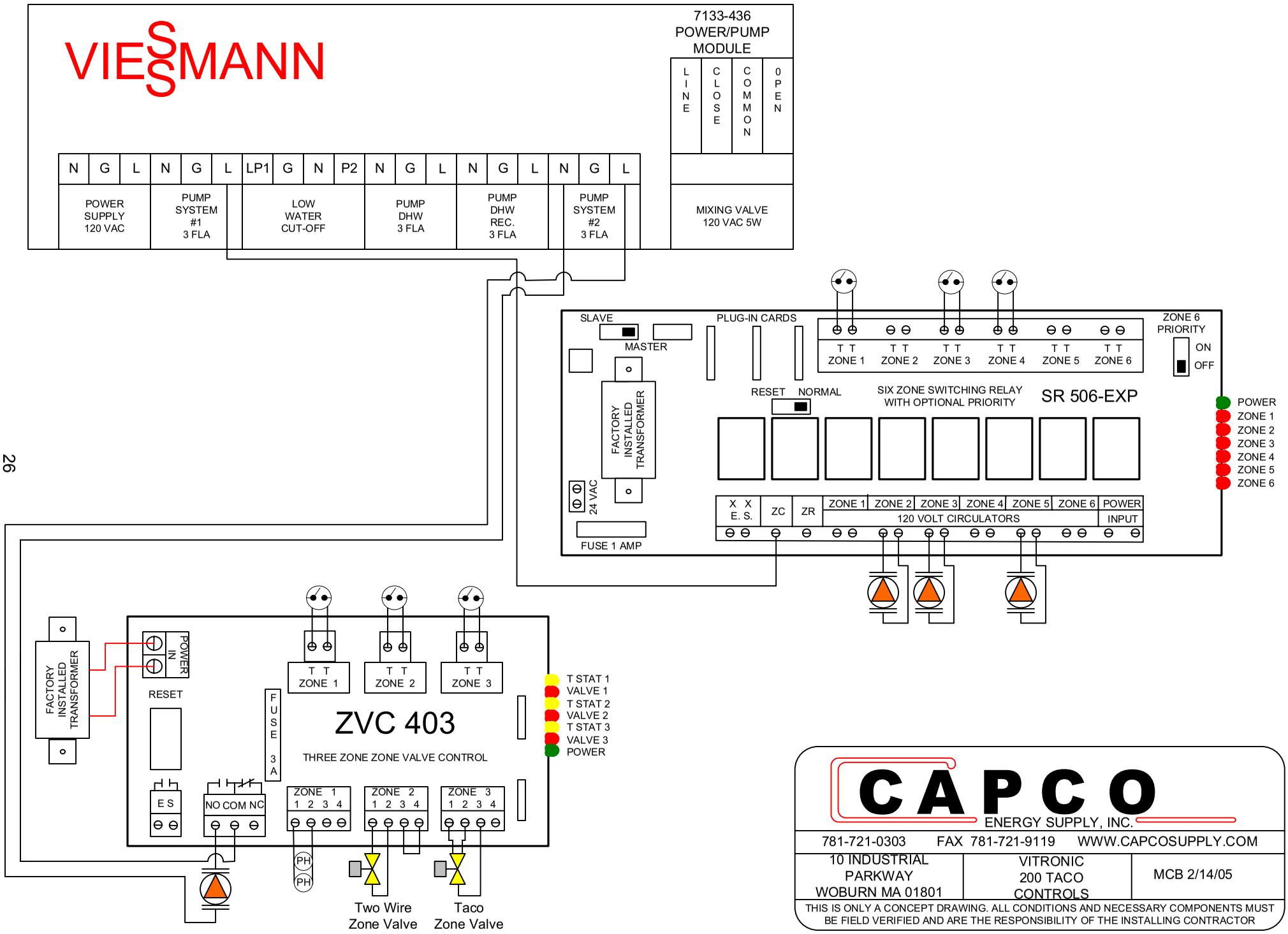

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VITRONIC
200 TACO
CONTROLS

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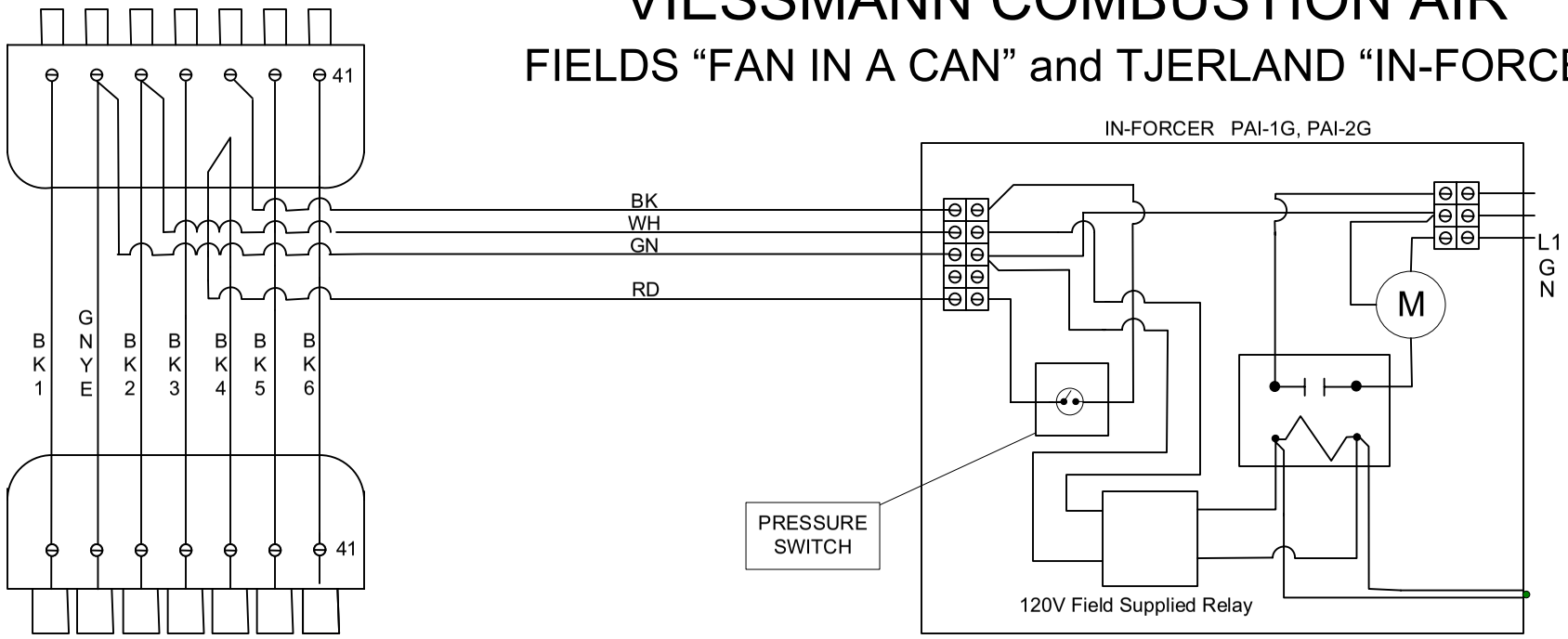
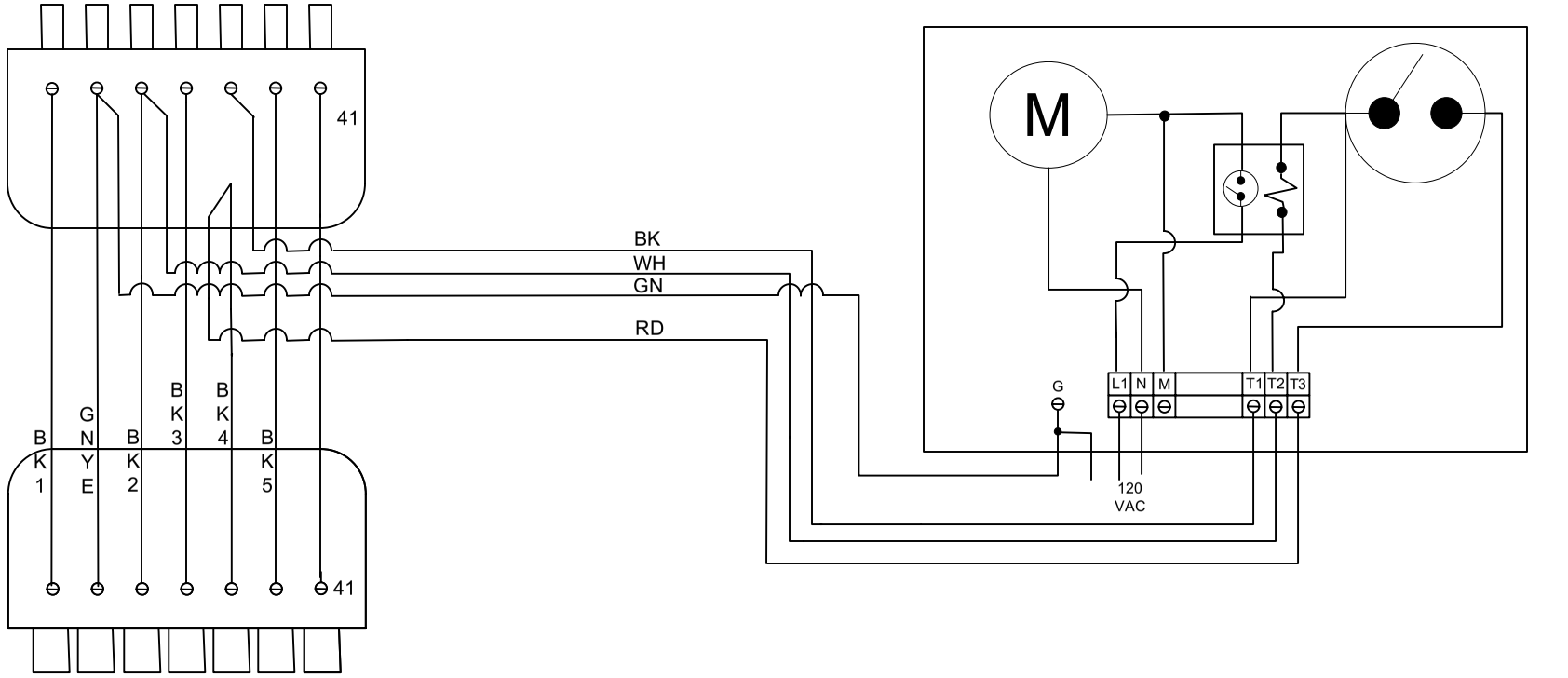
VIESSMANN COMBUSTION AIR

FIELDS “FAN IN A CAN” and TJERLAND “IN-FORCER”



FAN IN CAN CAS-3



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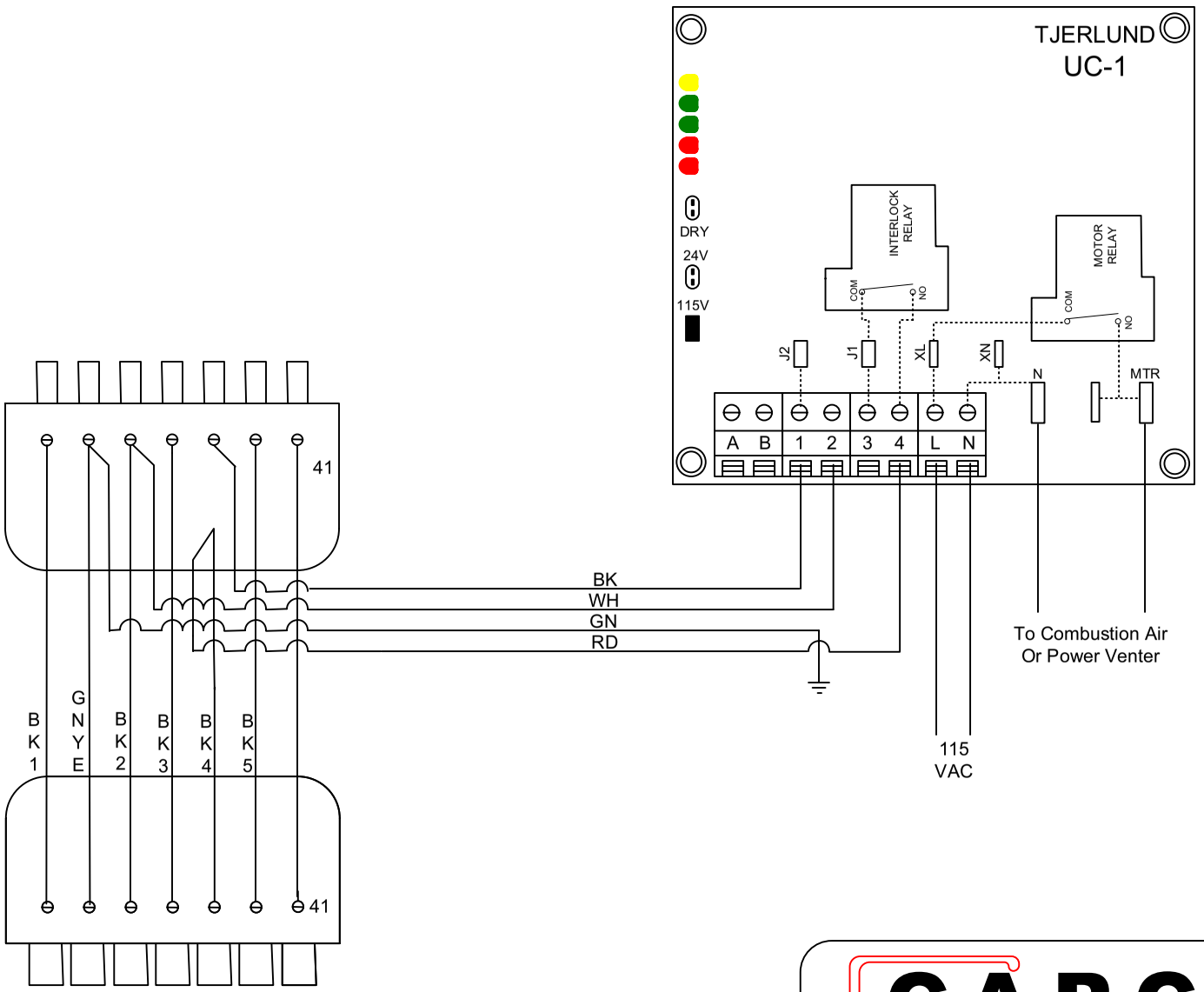

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VIESSMAN
WITH UC-1

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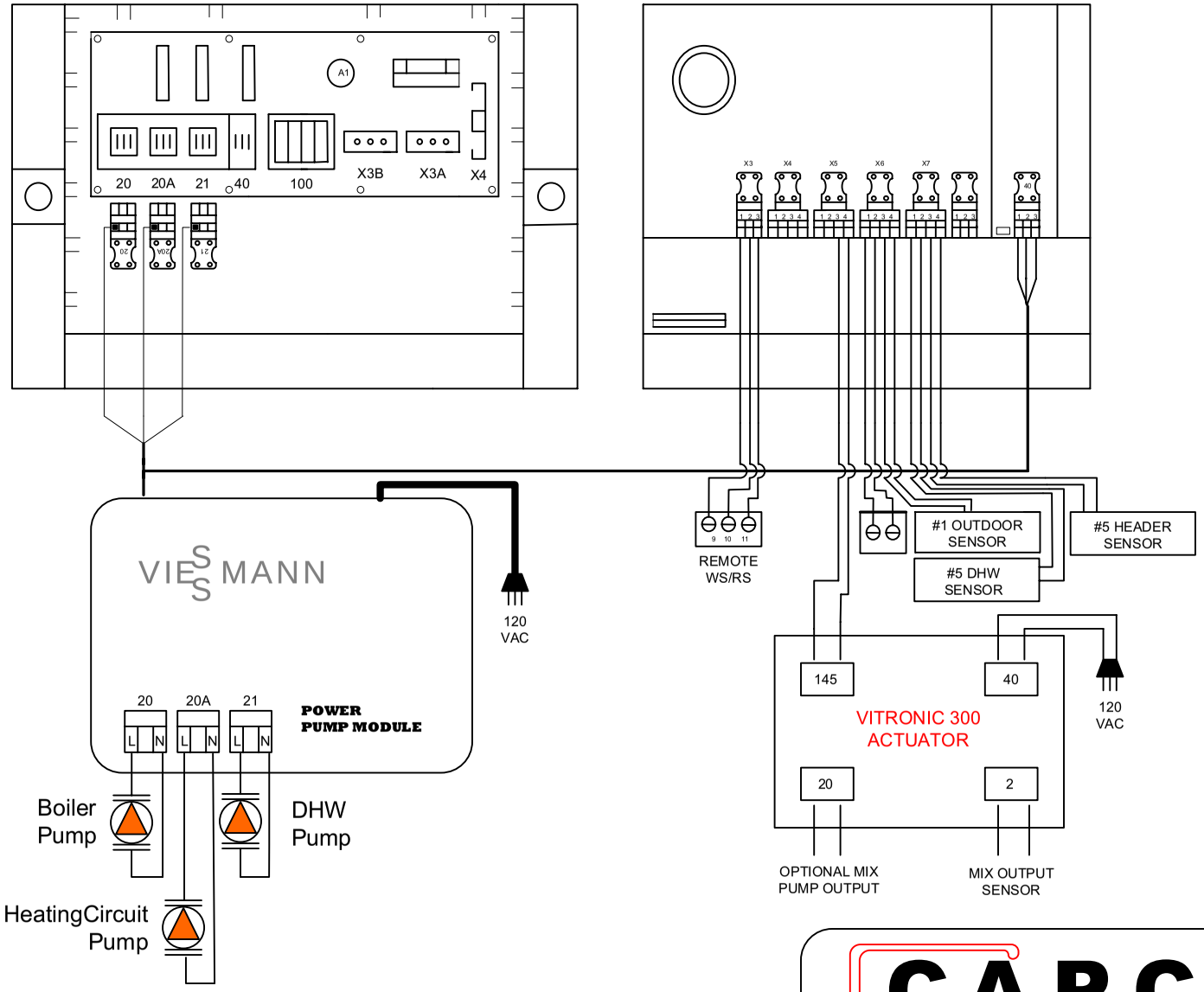
VITODENS CONTROLS



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Vitodens Controls

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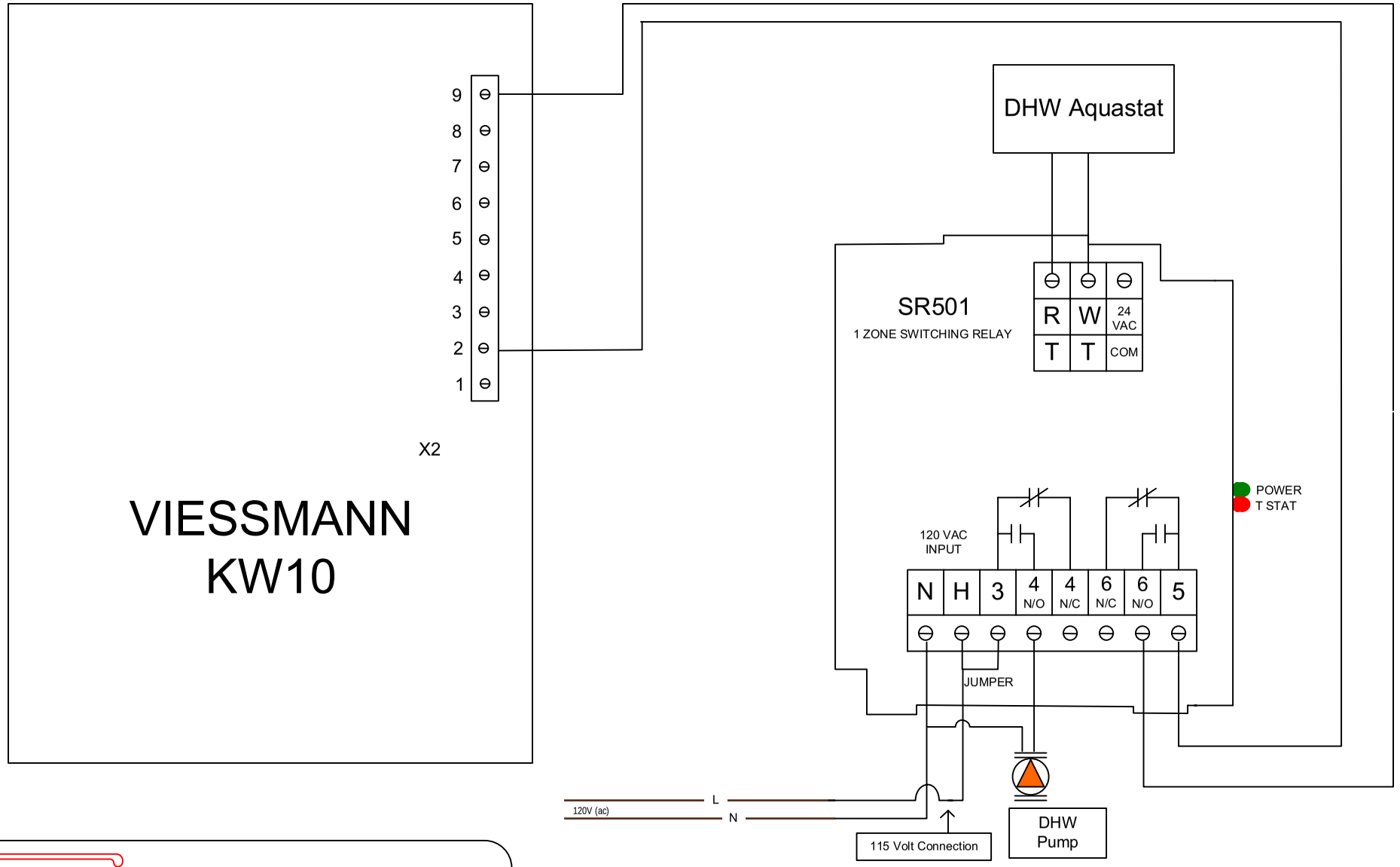
DOMESTIC HOT WATER WITH VITOTRONIC 100 KW10



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Pumping Away[1]

The Point of No Pressure Change

The point where the expansion tank connects to a closed hydronic system is called the Point of No Pressure Change. The Point of No Pressure Change is the location in the system where the circulator cannot have any affect on the pressure.

The Correct Position of the Circulator

The position of the circulator in a hydronic heating system is critical. For any number of reasons, in the middle 1940's boiler manufacturers began to deliver their assembled packages with the circulator mounted on the return side of the boiler. This delivery practice found its way into installation practices, and before long most contractors were putting the circulator on the return side of the boiler as a standard practice.

Installing the circulator on the return side of the boiler, pumping towards the Point of No Pressure Change, can create problems with the system. When systems are assembled in this manner, the circulator cannot raise the pressure any higher than it already is, i.e. whatever the tank pre-charge pressure is. The circulator has to move water, however, and it does this by decreasing its inlet pressure below the pressure at the Point of No Pressure Change.

This practice can lead to the following problems:

1. Air can enter the system, usually in commercial applications, if the pump drops the inlet pressure below zero.
2. If you do not "Pump Away" from Point of No Pressure Change, it becomes difficult to remove air from the system. The lower pressure on the inlet side of the circulator can allow air that has been absorbed into the water to be released into the system.

If you install the circulator immediately after the expansion tank and "Pump Away" from the Point of No Pressure Change, the circulator adds whatever head it develops to the static pressure that already exists in the pre charged system.

Pumping towards the Point of No Pressure Change creates system operating problems which are eliminated if you "Pump Away". All wet rotor circulators in production today are capable of handling high temperature water produced by the boiler when the pump is positioned to "Pump Away."

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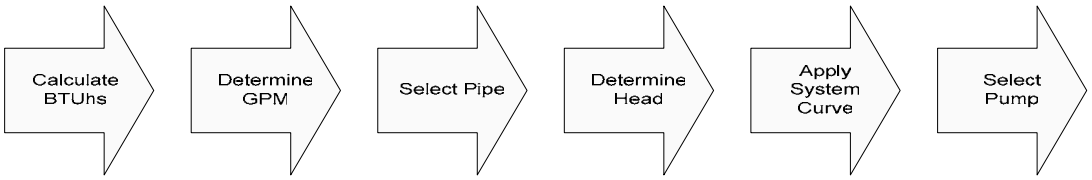
[1] From Pumping Away (and other really cool piping options for hydronic systems) by Dan Holohan, available at www.heatinghelp.com

How to Select a Pump

Follow This Path to Select the Proper Pump:



1. **Calculate BTUh** – BTUh is the heat output capability of the heat source over time.
    a) Given in specification, or
    b) Heat Loss Calculation

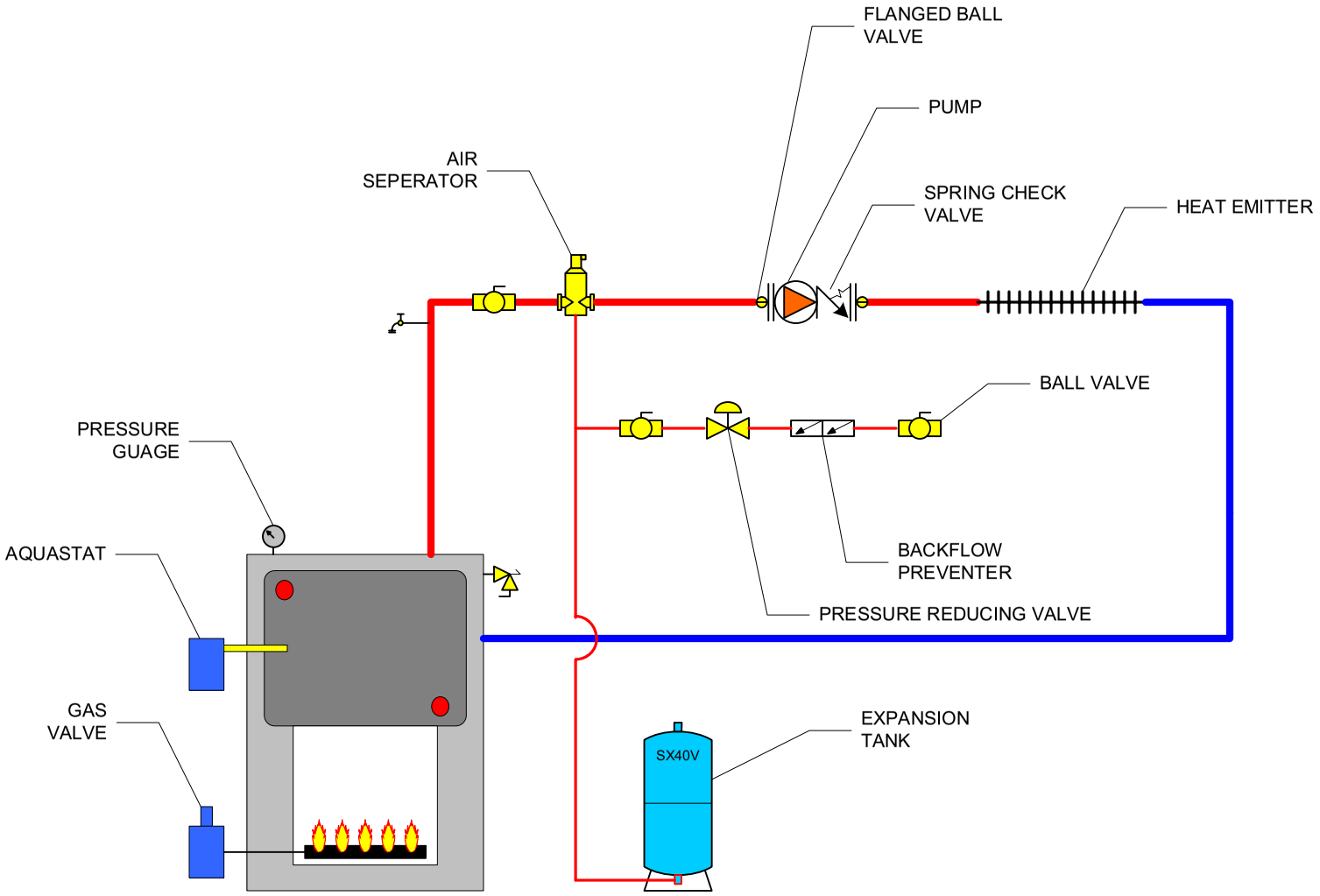
2. **Determine GPM**
    a) Formula: Solve for GPM by using the equation: GPM = BTUh / (500 x ΔT)
    b) Shortcut for Calculating GPM: For systems with a ΔT of 20 degrees F, divided output boiler BTU's by 10,000

3. **Select Pipe** – This step ensures the velocity through the piping network is under four feet/second. Excess velocity could cause noise and/or premature erosion of the piping system. Most hydronic engineers use .05 ft head per linear foot of pipe as "rule of thumb" to size pipe.

4. **Determine the System Piping Friction Head** – Head is calculated by multiplying the equivalent length of the circuit of pipe, including the valves and fittings, by the friction loss values located in the pressure drop charts for various piping materials, ie copper, pex, and steel.

5. **Apply System Curve** – Overlay the system curve template on a preliminary pump curve selection to pick the "Operating Point". The specified duty point and the actual operating point will often occur at different flow and heat performance rates found on manufacturers pump charts.

6. **Select Pump** – From manufacturer's pump charts.



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BASIC HYDRONICS

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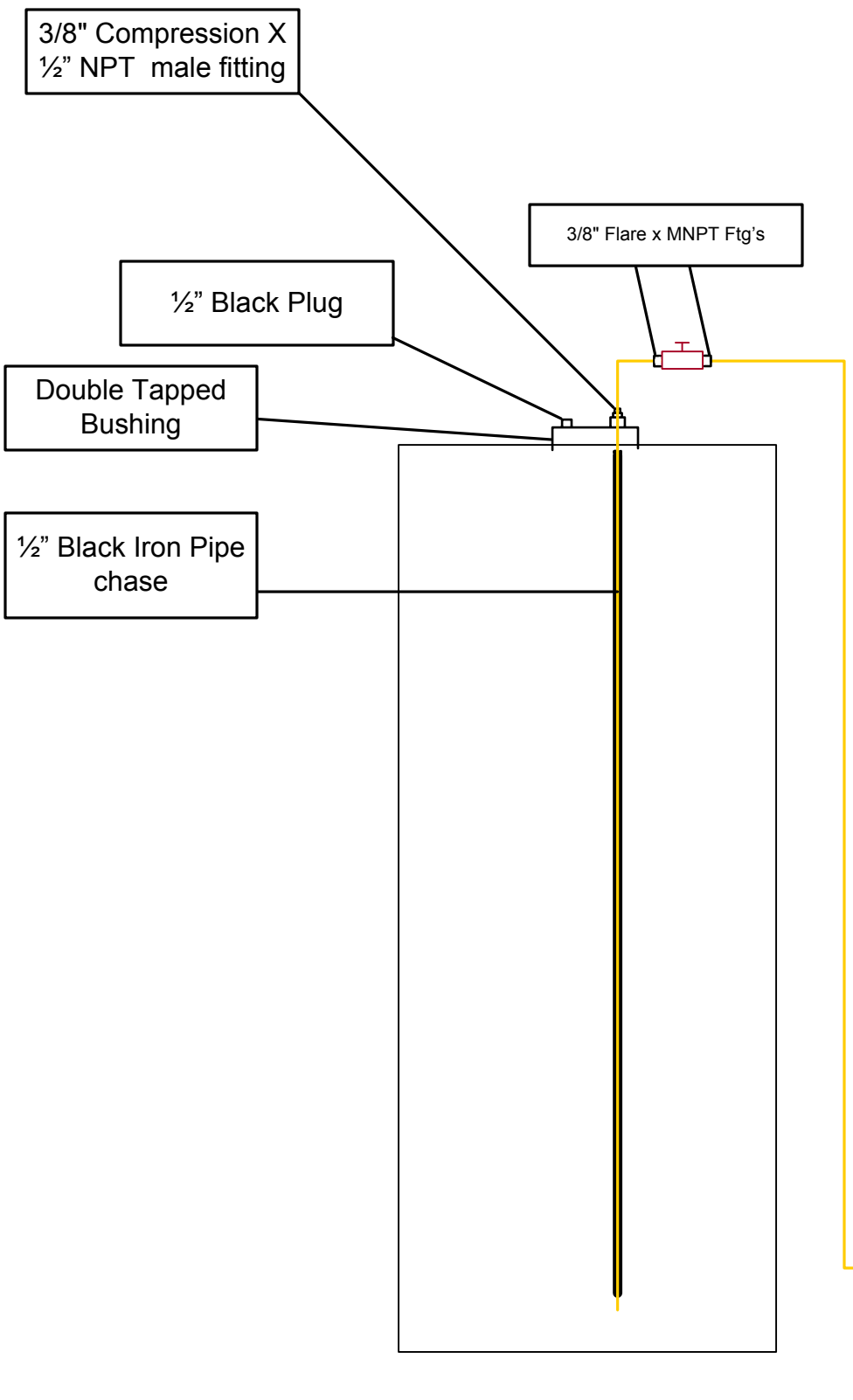
Single Roth Oil Tank Piping Schematic



Material List

1.) Qty (3) Oil Firomatic Valves

2.) Qty (4) 3/8" FM x 3/8" Flare Adapters with Qty (4) nuts

3.) Roll of Copper Tubing 3/8"

4.) Qty (1) ½" Black Plug

5.) Qty (1) 2" Double Tapped Bushing with ½" taps

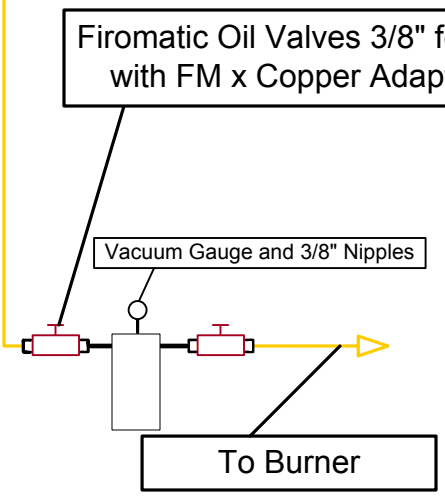
6.) Qty (1) ½" Male x 3/8" Compression fitting for slipping tubing through

7.) Qty (1) ½" Black Iron Pipe x 5'

8.) Qty (2) 3/8" x 4" Black Nipples

9.) Qty (1) Spin & Grin Vacuum Gauge for Garber Oil Filter

10.) Garber Filter



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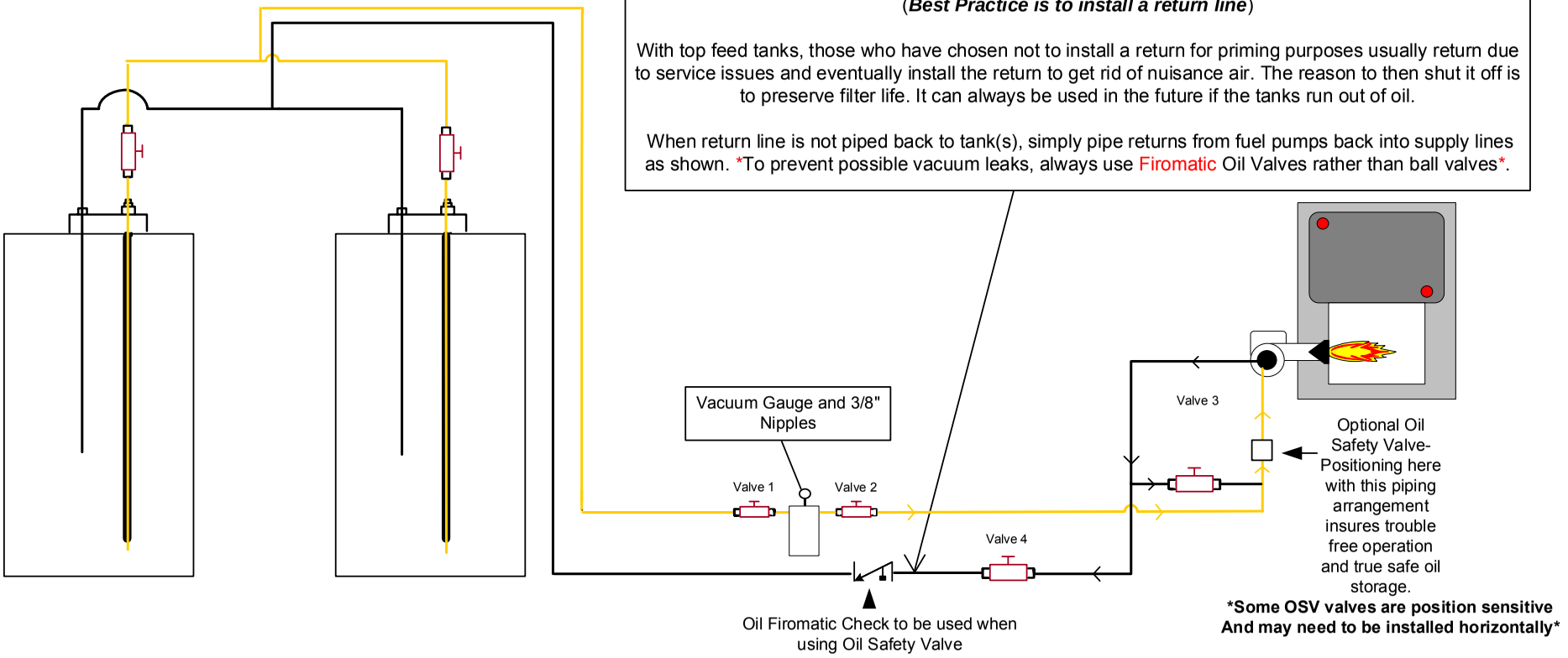
Multiple Roth Oil Tank Piping Schematic

Optional Return Line:

(***Best Practice is to install a return line***)

With top feed tanks, those who have chosen not to install a return for priming purposes usually return due to service issues and eventually install the return to get rid of nuisance air. The reason to then shut it off is to preserve filter life. It can always be used in the future if the tanks run out of oil.

When return line is not piped back to tank(s), simply pipe returns from fuel pumps back into supply lines as shown. *To prevent possible vacuum leaks, always use Firomatic Oil Valves rather than ball valves*.


Vacuum Gauge and 3/8" Nipples
Valve 1
Valve 2
Valve 3
Valve 4
Optional Oil Safety Valve- Positioning here with this piping arrangement insures trouble free operation and true safe oil storage.
Some OSV valves are position sensitive And may need to be installed horizontally
Oil Firomatic Check to be used when using Oil Safety Valve

During Priming of Burner, Valve 1, Valve 2 and valve 4 will stay open while Valve 3 stays closed. The cad cell should be fooled and the oil solenoid unplugged. Each tank shall be primed individually. This can be achieved by opening the second tank while simultaneously closing the first. Once the fuel line is clear of ***all*** air, then shut off power to burner and open Valve 3 and close valve 4. Valve 3 must be open in order to prevent dead heading the fuel pump.

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Roth tank fuel line piping

Michael Fox 02/18/2007

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3.6 Water/ Glycol Mixture:

Selecting the percentage of Glycol Mixture:
Freeze protection is essential to the snow melting system. For typical applications, Viega recommends using 40% Propylene Glycol. Ethylene Glycol is accepted. Use the table to determine the freezing point of the water/ glycol mixture based on % glycol by volume.

Note:
Automotive antifreeze is not recommended; the silicates in automotive antifreeze can coat and foul heat transfer surfaces and plug the system, reducing energy efficiency.

	Freezing Point (°F)	
Glycol Mixture	**Ethylene Glycol**	**Propylene Glycol**
30%	3.7	8.4
40%	-12.6	-6.7
50%	-35.0	-30.0

Table 3.6A

Glycol effects on the system:
The material properties change according to the % glycol mixture. Use the table to adjust the flow rate and pressure drop calculated through the tubing (refer to 3.7 and 3.8 for values).

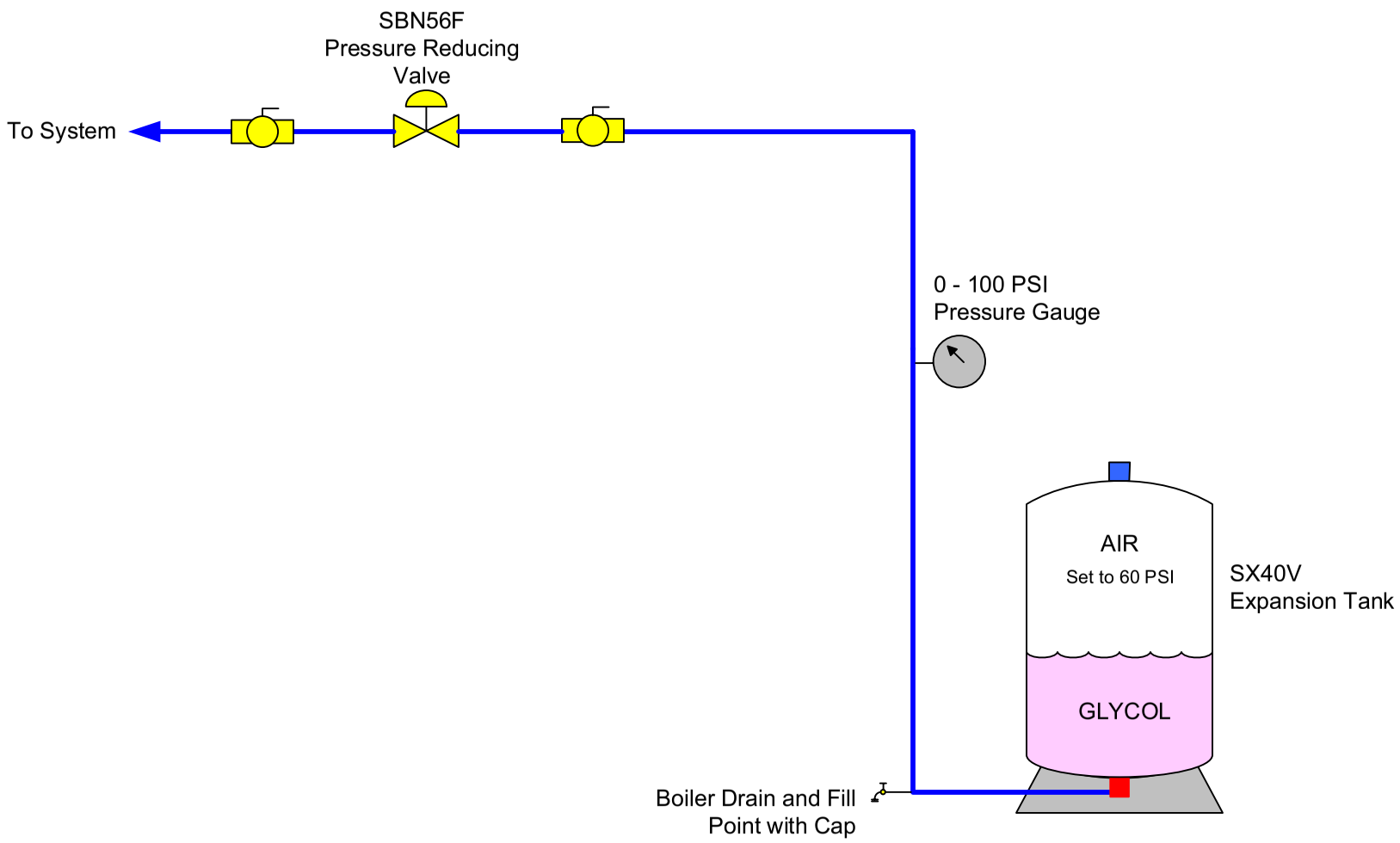
Glycol Effects on the System		
Glycol Mixture	**Flow Rate % Increase Multiplier**	**Pressure Drop % Increase Multiplier**
30%	5% (1.05)	20% (1.20)
40%	8.5% (1.085)	25% (1.25)
50%	12.5% (1.125)	31% (1.31)

Table 3.6B

Procedure:
1. Use the table to find the % increase multiplier (based on the % glycol mixture).

2. Multiply the flow rate and pressure drop figures by the multiplier.

Example:
Glycol mixture: 40%
Calculated flow rate: 7 gpm
Flow rate multiplier: 8.5% (1.085)
Adjusted flow rate calculation:
7 gpm x 1.085 = 7.6 gpm
Calculated pressure drop: 20 ft of hd
Pressure drop multiplier: 25% (1.25)
Adjusted pressure drop calculation:
20 ft of hd x 1.25 = 25 ft of hd



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Glycol Fill System

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10 Industrial Parkway Woburn, Ma. 01801	Basic Snowmelt/Axiom	MDF 5/27/2006

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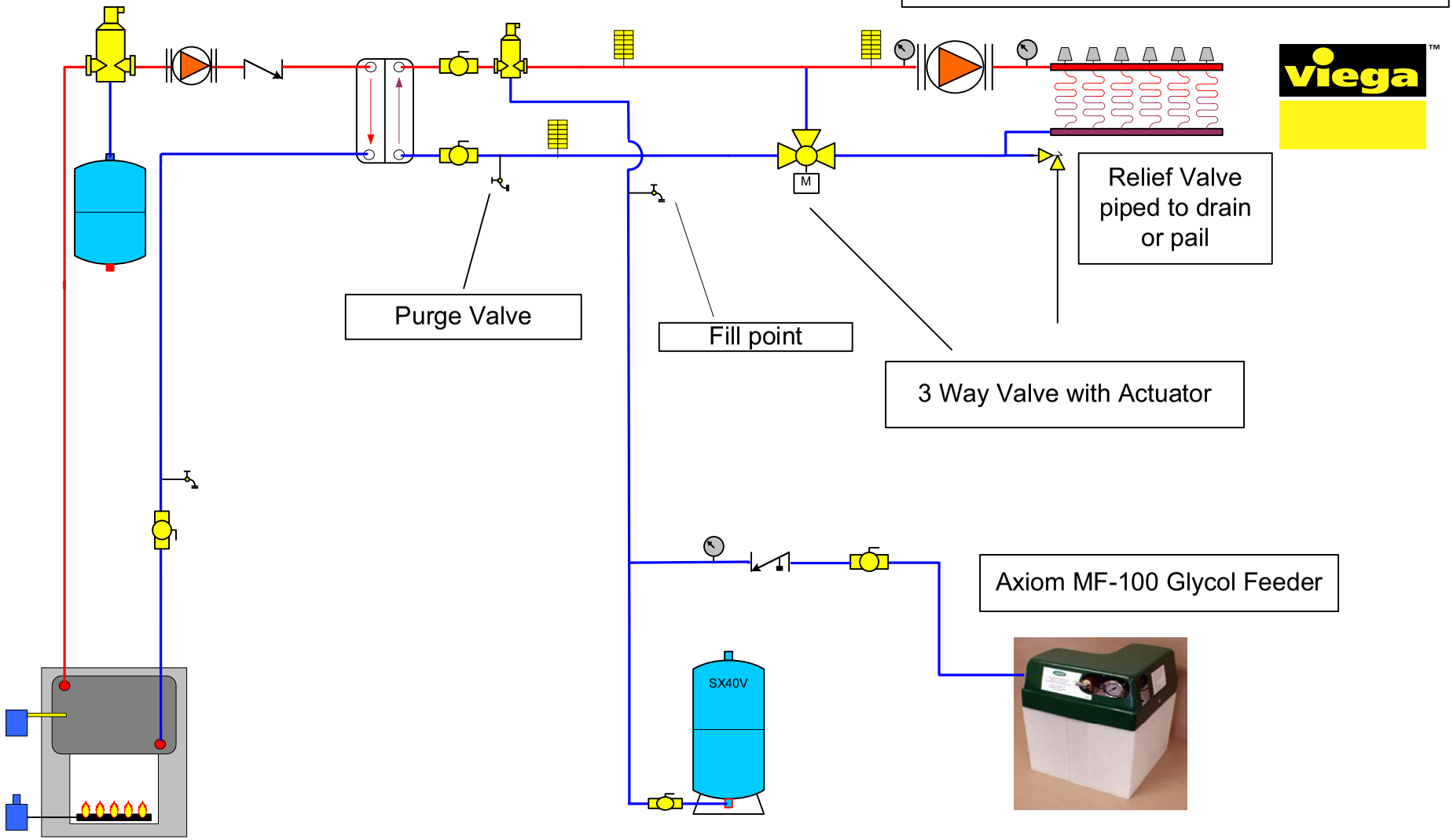
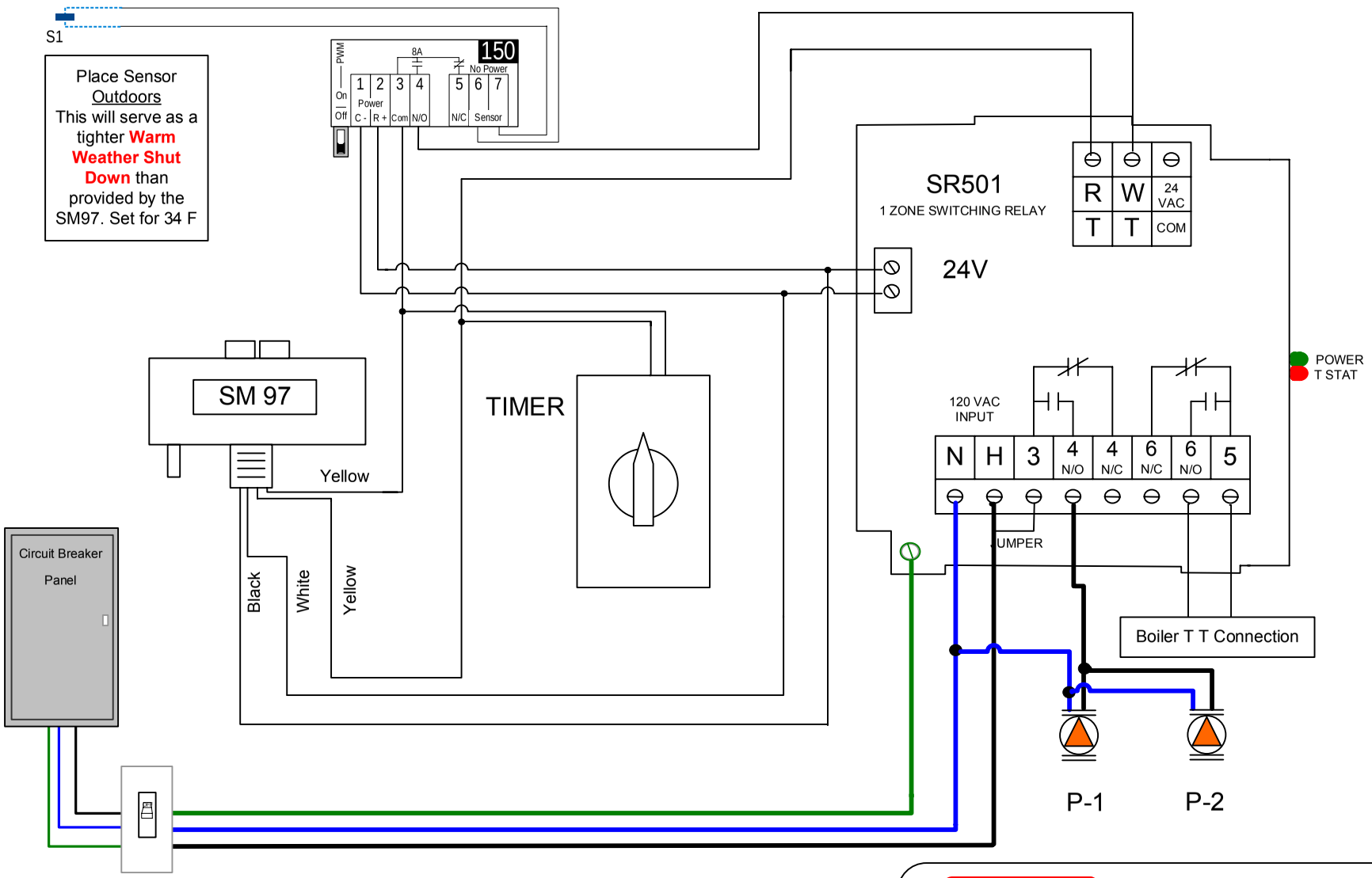


Basic Wiring for Snowmelt



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Basic Snowmelt Wiring

Michael D. Fox
02/21/2007

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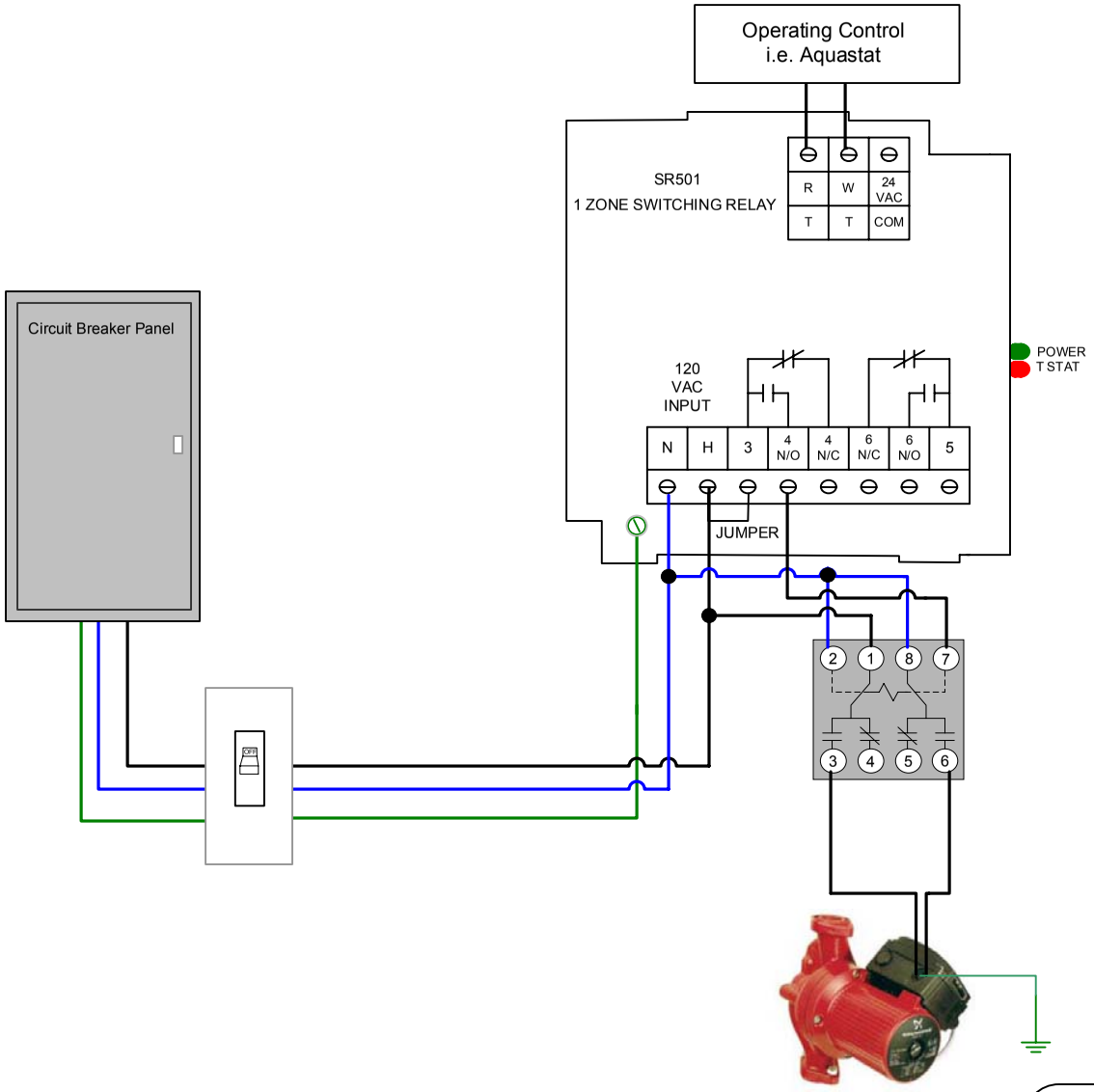
Wiring Diagram for a pump with a starting amperage greater than 5 amps



This is a depiction of a 115 volt circuit. 115 volt or 230 Volt power supply is possible. For 230 Volt, the nuetral leg would be hot and all of the other connections would remain the same.

The Contactor chosen must be capable of handling the I amps, also known as the starting amps. That number must be the minimum amount that the contactor is rated for.

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Wiring for a pump with greater than 5 amp draw on start

Michael D. Fox
02/02/2007

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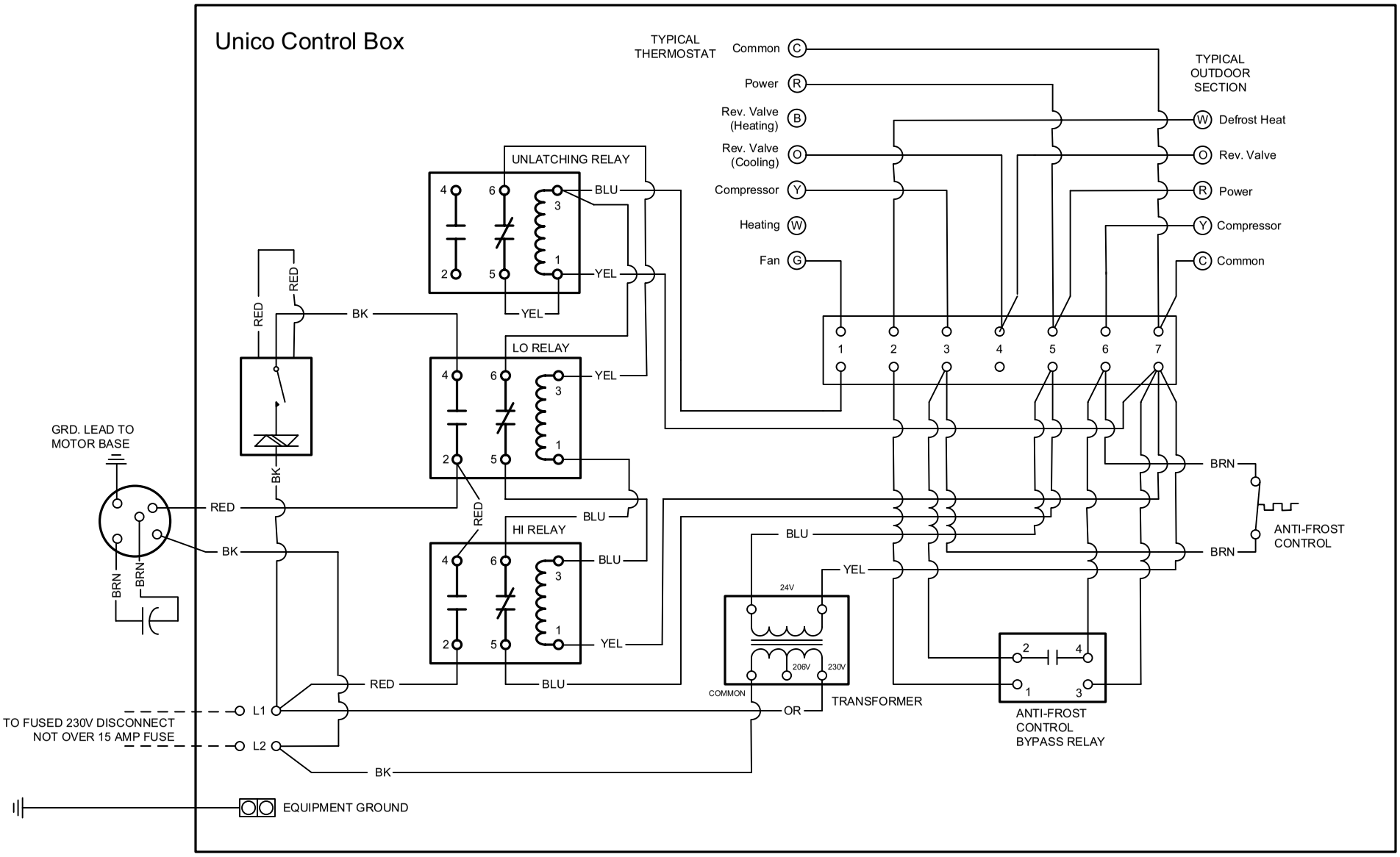
Unico Control Box



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UNICO CONTROL BOX 2003

02/20/04 JEH

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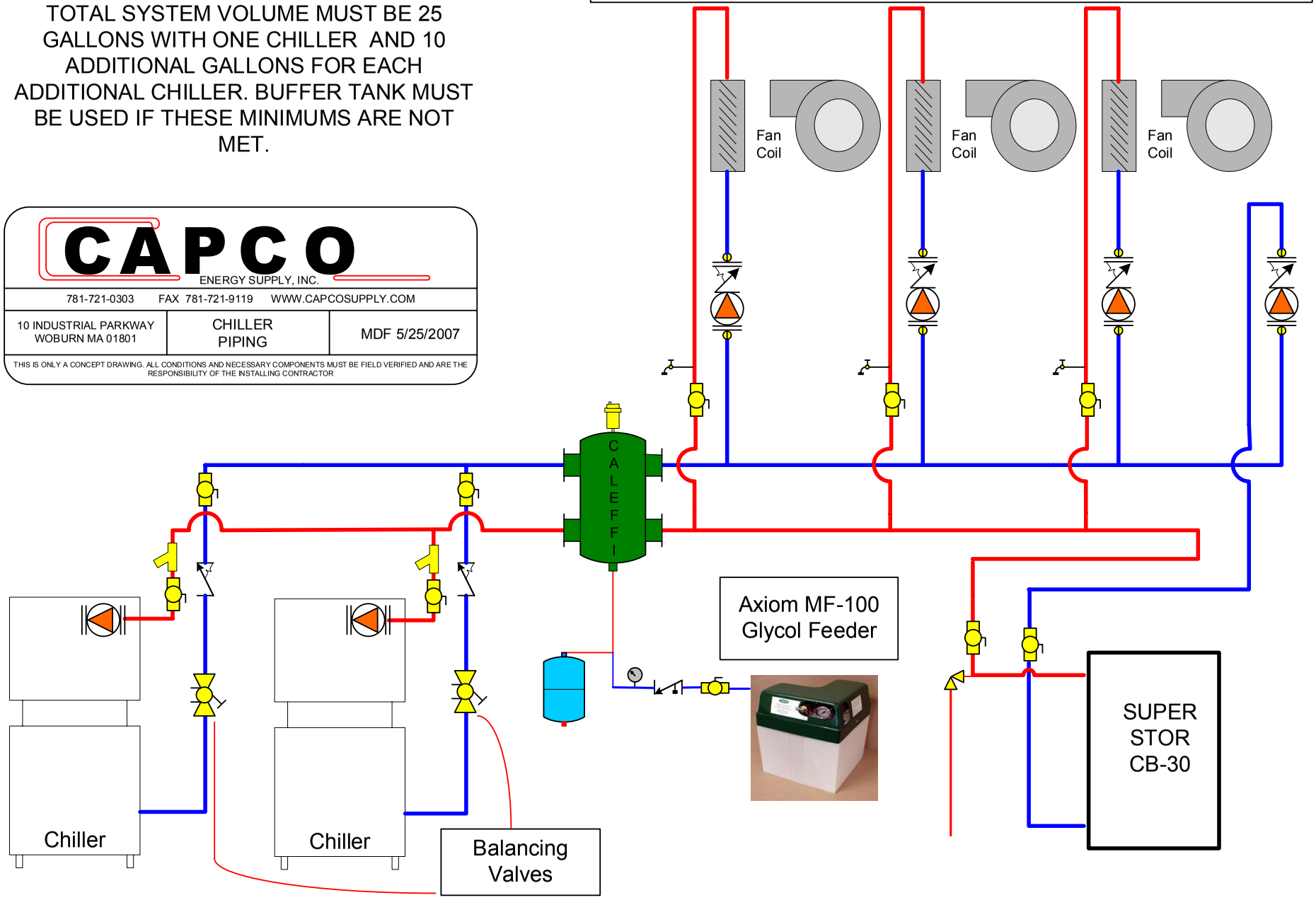
Multiple Unichiller Basic Piping Diagram

For 50% Mix
Glycol Flow Rate factor is GPM x 1.125
Glycol Head Loss Factor is Head loss X 1.31

NOTE
TOTAL SYSTEM VOLUME MUST BE 25 GALLONS WITH ONE CHILLER AND 10 ADDITIONAL GALLONS FOR EACH ADDITIONAL CHILLER. BUFFER TANK MUST BE USED IF THESE MINIMUMS ARE NOT MET.



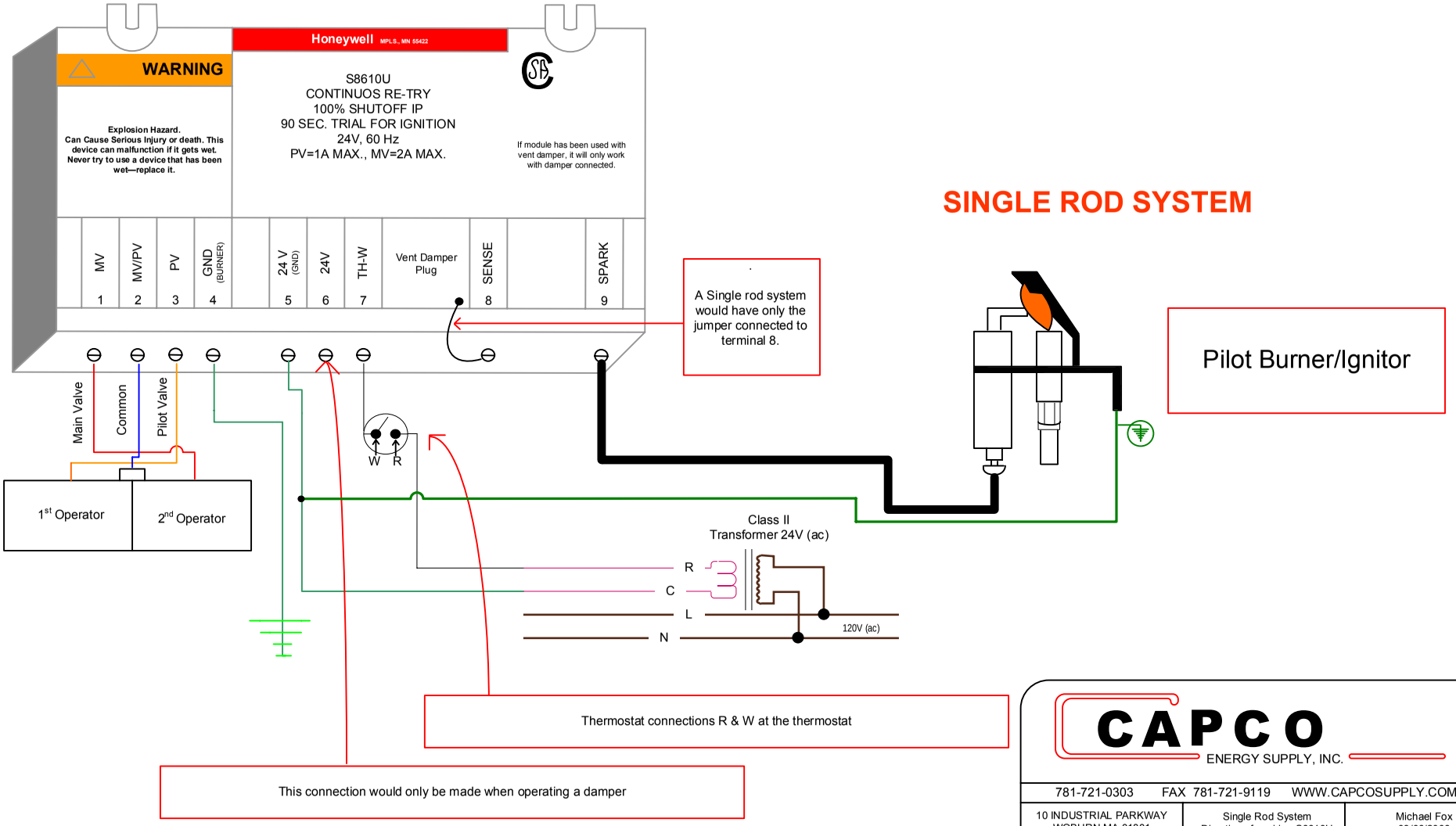
SINGLE ROD SYSTEM

(Ignition Electrode Does Both)

Wiring Instructions for adapting the S8610U Honeywell Ignition Control to any boiler

For Single Rod Systems (leave Jumper)
This applies to the following models with S8600:
Viessmann: ECD, ECDS, ECV, ATOLA AR, GS-1, GS-10

All Buderus Boiler Models with S8600 Controls have a (single rod system)



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Single Rod System
Directions for wiring S8610U

Michael Fox
09/06/2006

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DUAL ROD SYSTEM

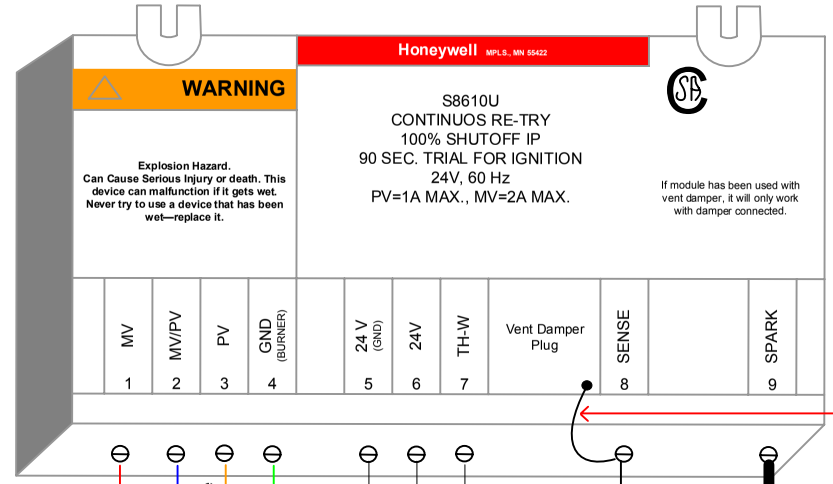
(Has Separate Ignition electrode and Flame Sensing Electrode)

Wiring Instructions for adapting the S8610U Honeywell Ignition Control to any boiler

For Single Rod Systems SEE ***SINGLE ROD SYSTEM***
This applies to the following models with S8600:
Viessmann: ECD, ECDS, ECV, ATOLA AR, GS-1, GS-10

All Buderus Boiler Models with S8600 Controls have a (single rod system)

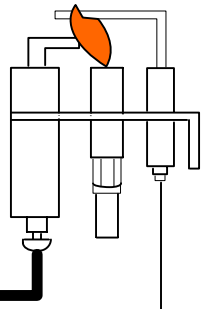
For Dual Rod Systems (remove jumper but cut only after testing) This applies to Viessmann Atola RS boilers and any other boilers that use the Honeywell S8600


Honeywell MPLS., MN 55422
WARNING
Explosion Hazard.
Can Cause Serious Injury or death. This device can malfunction if it gets wet. Never try to use a device that has been wet—replace it.
S8610U
CONTINUOS RE-TRY
100% SHUTOFF IP
90 SEC. TRIAL FOR IGNITION
24V, 60 Hz
PV=1A MAX., MV=2A MAX.
If module has been used with vent damper, it will only work with damper connected.
MV 1
MV/PV 2
PV 3
GND (BURNER) 4
24 V (GND) 5
24V 6
TH-W 7
Vent Damper Plug
SENSE 8
SPARK 9

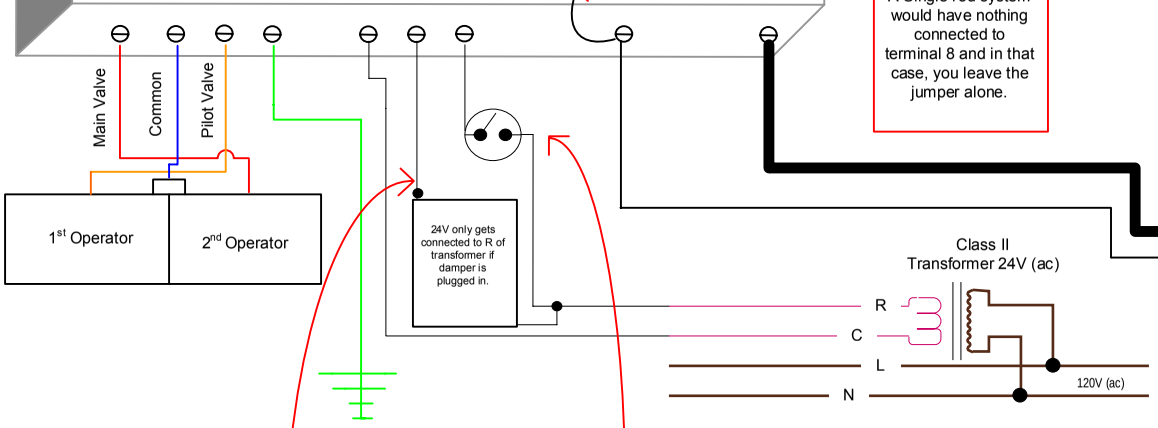
Remove Jumper and cut when using with two rod system such as the Individual sensing electrode and spark electrode like shown here.

A Single rod system would have nothing connected to terminal 8 and in that case, you leave the jumper alone.

THIS IS A DUAL ROD SYSTEM



Pilot Burner/Ignitor



Thermostat connections R & W at the thermostat

This connection would only be made when operating a damper

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Dual Rod System
Directions for wiring S8610U

Michael Fox
09/06/2006

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AXIOM **INDUSTRIES LIMITED**

MODEL MF200 'PRESSURE PAL' MINI SYSTEM FEEDER

The 'PRESSURE PAL' is ideal for feeding and pressurizing smaller closed hydronic systems that do not require cold static fill pressures higher than 18 psig. It is compatible with both water and glycol/water solutions. Perfect for small boiler/chiller systems, snow/ice melt circuits, outside air heating/cooling glycol coils, solar heating systems.

Fig. 1: Shown with Optional Tank Shelf

FEATURES and BENEFITS

- *6.0 US gallon (22.7 liter) tank for storage and mixing*
- *Power supply plugs into any standard 115 VAC outlet*
- *Diaphragm pump can run dry without damage*
- *No direct connection to potable water supply eliminates need for backflow prevention*
- *Allows mixing of treatment chemicals into make-up water*
- *Diverter valve allows easy purging of air on initial start-up, and manual agitation of solution*
- *Prevents major floods - in the event of system rupture, only the contents of the tank will be pumped into the system*
- *Provides leak detection - dropping fluid level provides immediate notice that the system has developed a leak*
- *Fluid level switch shuts the pump off if the storage tank level gets too low*
- *Auxiliary dry contact included for remote low pressure alarm*

Represented By:

SLS-04-0801

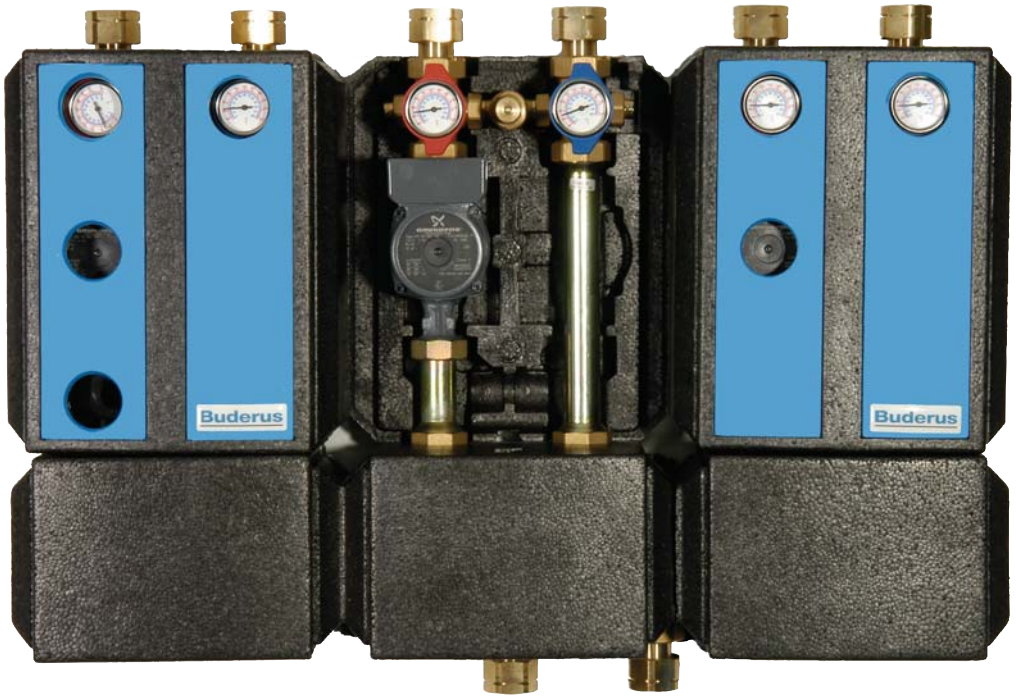
2615 Wentz Avenue, Saskatoon, SK S7K 5J1 Ph: (306) 651-1815 Fax: (306) 242-3373
email: sales@axiomind.com website: www.axiomind.com

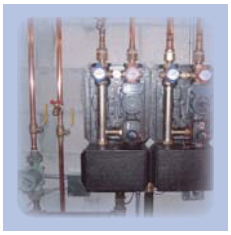
Buderus

Quick-Fit™

Modular Piping System

Simplifies and Speeds Any Boiler Installation





- Quick-Mix Mixing Station for Radiant Flooring Applications
- Quick-Pump Station for High-Temperature Zones
- Quick-Header Manifold for Multi-Temp Heating Systems
- Saves Time and Money on Any Boiler Installation
- Eliminates Incorrect Valve or Motor Installations
- Ensures a Clean, Finished and Professional Installation

www.buderus.net

Buderus

Quick-Fit™ Modular Piping System

The Quick-Fit System takes only minutes to connect and includes all the piping, valves, circulating and control elements to feed both radiant floor heating zones and conventional high-temperature heating zones. The Quick-Fit System can be used to connect virtually any piping arrangement.

Quick-Mix Station

The Quick-Mix Station is a fully assembled radiant heat mixing station that conveniently combines a motorized mixing valve, circulator pump, shutoff valves, a check valve and temperature gauges in a compact, attractive foam-insulated unit. It includes everything needed to automatically adjust water temperature for radiant floor heating. The mixing valve is controlled by a Buderus Logamatic 2107 control which considers both inside and outside temperatures for maximum efficiency and economy.

Quick-Pump Station

The Quick-Pump Station simplifies installation and piping of high-temperature heating applications such as fin-tube baseboard, panel radiators or hydo-air systems. An optional larger pump is available.

TC62 Outdoor Reset Control

The optional TC62 Outdoor Reset Control Motor can be added to the Quick-Mix Stations to configure systems that require multiple mixed water temperatures. The unit's digital display shows water temperature and adjustments. The TC62 has programmable heating curve and automatic warm weather shutdown. Sensor wiring is quick and easy using plug-in cables. The unit also accepts input from optional room sensors.

Specifications

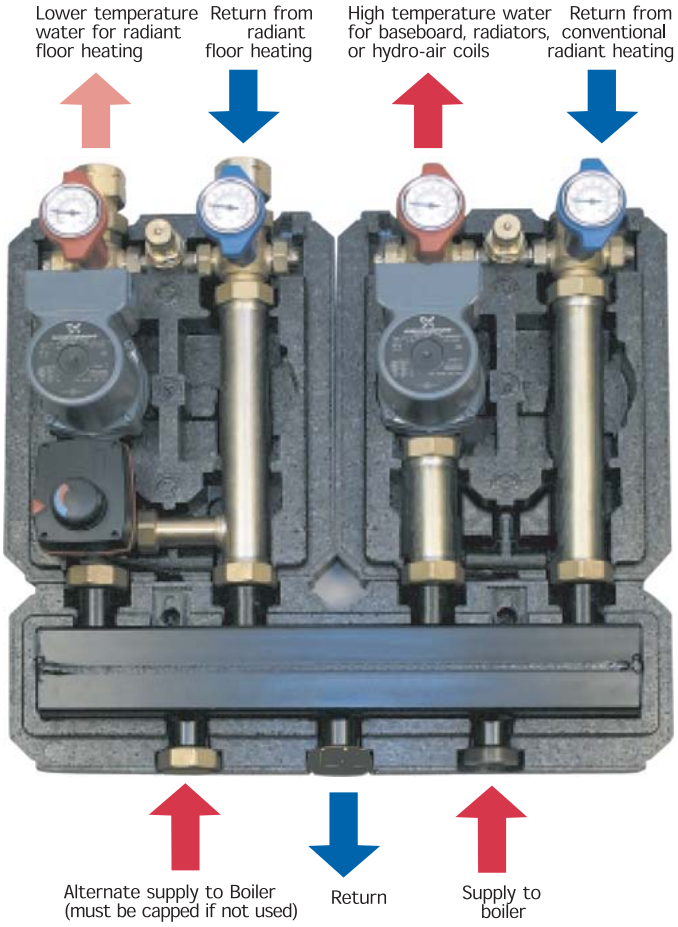
Fittings	Hot-pressed brass, Ms5 Precision Pipes
Pipe Systems	Precision Pipes
Insulated Shell	Epp with patented snap seam
Valve Handles	Heat-resistant plastic
	O-ring seal: EPDM elastomers
	Flat seals: AFM 34 or EPDM
Ball Seats	PTFE
	Model: Grundfos UPS25-58
	Optional: Grundfos UP26-99
	Voltage: 115 Vac/60Hz

Dimensions

Height	13¼"	**Width**	11½"
Depth	7¾"		
Inlet/Outlet	5⅛"	**Connection**	1¼" NPT Female

Quick-Header Manifold

Quick-Header Manifolds allow you to combine multiple stations in order to customize any application. Available in a 2-station or 3-station configuration, they simplify installation, requiring only a supply to and return from the header. Quick-Header manifolds are made of heavy-gauge welded steel and have durable insulated covers. Union connections make mounting Quick-Mix and Quick-Pump stations to the Quick-Header manifold fast and easy.


Lower temperature water for radiant floor heating
Return from radiant floor heating
High temperature water for baseboard, radiators, or hydro-air coils
Return from conventional radiant heating
Alternate supply to Boiler (must be capped if not used)
Return
Supply to boiler

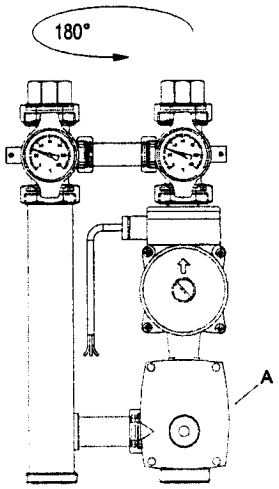
50 Wentworth Ave
Londonderry, NH 03053
Phone: 603-552-1100
Fax: 603-421-2719

444-99-006 12/04 © Buderus Hydronic Systems 2004

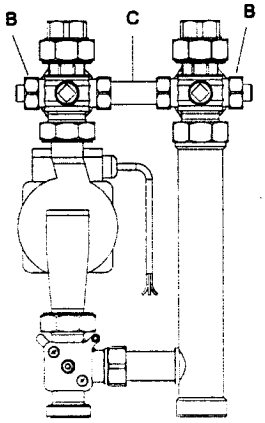
N.B.: If changes are made to works-mounted assemblies and components, all warranty and guarantee entitlements will become null and void.

FlowBox heating / Changing the flow and return lines

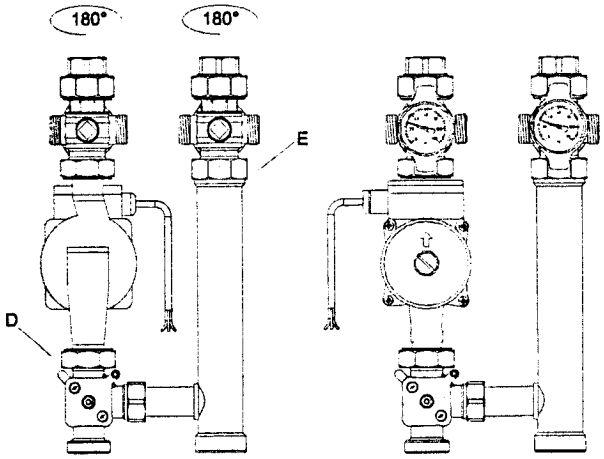
1st step
Remove servomotor **A** (see Fig. 3 Page 1 Mounting/Removal of the servomotor)
Rotate complete assembly by 180°



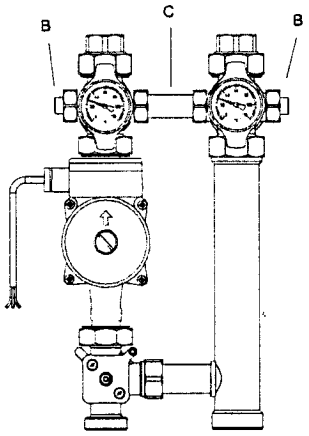
2nd step
Remove immersion sleeves **B** as well as the oveflow valve (connecting pipe) **C**.



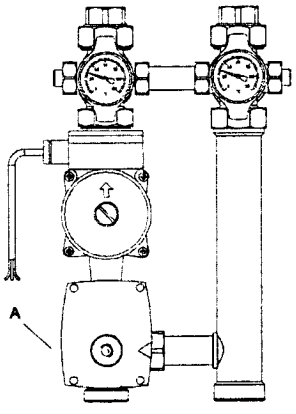
3rd step
Unscrew pump screw connection **D** as well as return ball valve screw connection **E**.
Rotate pump with flow ball valve and return ball valve by 180°.
Fiirmly tighten screw connections **D** and **E** again.



4th step
Re-mount immsersion sleeves **B** as well as the overflow valve (connecting pipe) **C**.
Important:
Pay attention to the direction of flow specified on the overflow valve.



5th step
Mount servomotor **A** (see Fig. 3 Page 1- Mounting/Removal of the servomotor).
Ensure correct direction of rotation (see diagram, Fig. 4).



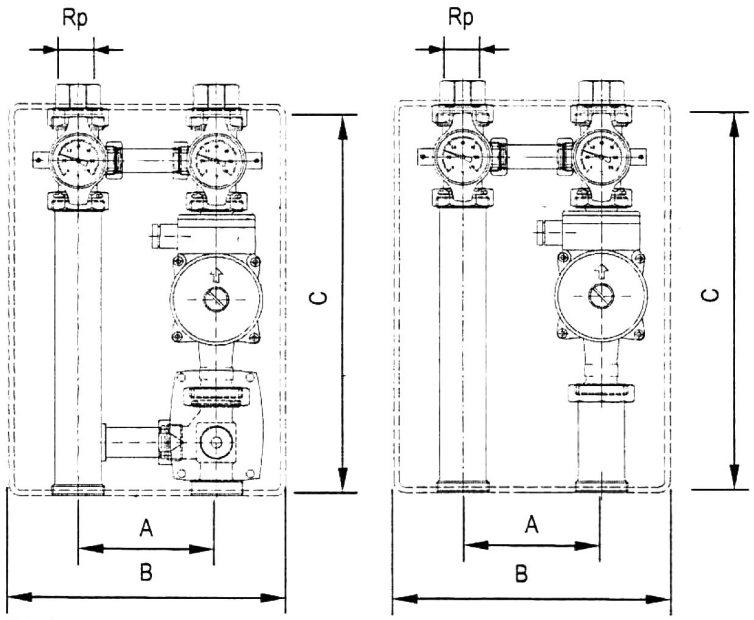


Abb. 1

Materials

Fittings	:	hot-pressed brass, Ms58
Pipe systems	:	precision pipes
Heat insulation cladding	:	EPP – with patented snap seam fitting
Grips	:	glass fibre-reinforced and temperature-resistant plastic
Gaskets	:	
O-ring seals	:	EPDM elastomers
Flat seals	:	AFM 34 or EPDM elastomers
Ball seals	:	PTFE

Technical data (Fig. 1)

***FlowBox* Typ**		**HK / HKM**	**HK / HKM**	**HK / HKM**	**HK / HKM**
Dimension		**DN 25**	**DN 25**	**DN32**	**DN32**
Max. adm. operating temp.	:	110°C	230 F	110°C	230 F
Min. adm. operating temp.	:	- 20°C	4 F	- 20°C	4 F
Max. adm. operating pressure	:	10 bar	145 psi	10 bar	145 psi

* Possibility of condensate formation at media temperature below 20°C / 68 F. In addition, suitable cooling agents must be used if the media temperature falls below the freezing point of water.

Overall height (incl. insulation) **C**:			
Width incl. insulation **B**	:		
Centre spacing **A**	:		
Screw connection **Rp**	:	11/4" NPT female	11/2" NPT female

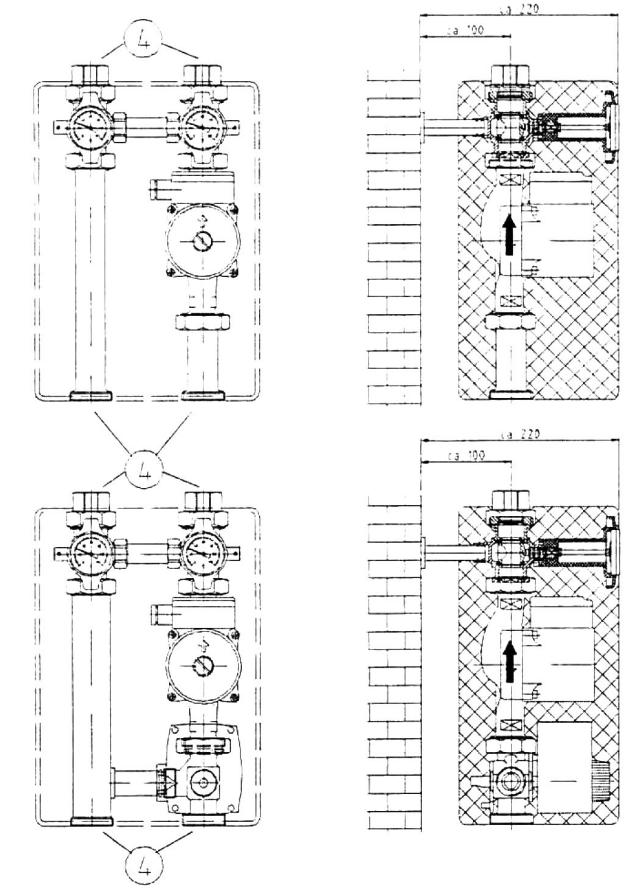


Fig. 2

Wall mounting (Fig. 2) → Wall brackets available as accessories!

1. Align wall bracket on wall and fasten in place using plugs and screws. If several control units are to be mounted next to one another, the correct centre spacing of the heat insulation components is dictated by the dovetails.
2. Push the back section of the heat insulation onto the square bolts of the wall bracket – by breaking through the specified points in the insulation (puncture these points using a screwdriver in advance).
3. The mounting lugs (recessed) for mounting on the bolts of the wall bracket are located on the rear of the ball valves. It is important that you hear the sound of the clip latching in place. After mounting, it must not be possible to easily pull the control unit towards you and off the bracket. Removal is described under 6.
4. Connect to boiler/heating circuit.
5. After the system has been filled and a complete seal-tightness check performed, attach the front section of the heat insulation.
6. Removing the control unit from the wall bracket: Use a screwdriver, pipe wrench or similar tool to pull the clips of the mounting lugs behind the ball valves up and out. **Important: The control unit is now loose! Take care to ensure that it cannot fall forwards and out of the wall bracket!**

Mounting and removal of the servomotor (Fig..3+4)

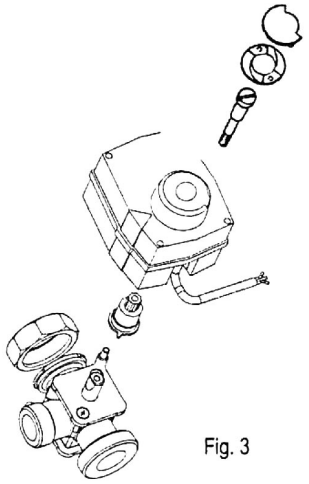


Fig. 3

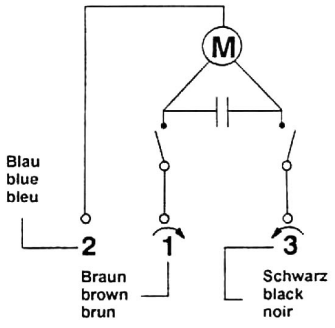


Fig. 4

Hydro Separator

series 548

cert. n° 0003
ISO 9001
01076/03 NA

Function

This device consists of several different functional components, each of which meets specific requirements, typical of the circuits used in heating and air-conditioning systems.

- **Hydronic separator**
  To keep connected hydronic circuits totally independent from each other.
- **Dirt remover**
  To permit the separation and collection of any impurities present in the circuits. Provided with a valved connection with discharge piping.
- **Automatic air vent valve**
  For automatic venting of any air contained in the circuits. Provided with a valved connection for maintenance purposes.

Product range

Series 548 Threaded hydronic separator	sizes 1", 1 1/4", and 1 1/2" F with union
Series 548 Flanged hydronic separator	sizes 2", 2 1/2", 3" and 4" ANSI Flange
Series 548 Flanged hydronic separator with insulation	sizes 2", 2 1/2", 3" and 4" ANSI Flange

Technical specification

series ⇨	548 threaded	548 flanged
Materials		
Separator body:	Epoxy resin painted steel	Epoxy resin painted steel
Air vent body:	Brass	Brass
Shut-off and drain valve body:	Brass	Brass, chrome plated
Air vent seal:	EPDM	VITON
Air vent float:	PP	Stainless steel
Performance		
Max. operating pressure:	150 psi (10 bar)	150 psi (10 bar)
Temperature range:	32-230°F (0÷110°C)	32-230°F (0÷110°C)
Medium:	Water, non hazardous glycol solutions	Water, non hazardous glycol solutions
Max. percentage glycol:	50%	50%
Connections		
Separator:	1", 1 1/4", 1 1/2" F with union	2", 2 1/2", 3" and 4" with flanged ANSI 150 CLASS
Front (thermometer pocket):	1/2" F	-
Air vent relief:	-	3/8" F
Drain valve:	hose connector	1 1/4" F

Technical characteristics of insulation (supplied on flanged models only)

Internal part

- Material: rigid closed cell expanded polyurethane foam
- Thickness: 2.3/8" (60 mm)
- Density: 3 lb/ft³ (45 kg/m³)
- Thermal conductivity (ISO 2581): 0.16 BTU/in (0.023 W/mK)
- Temperature range: 32-220°F (0÷105°C)

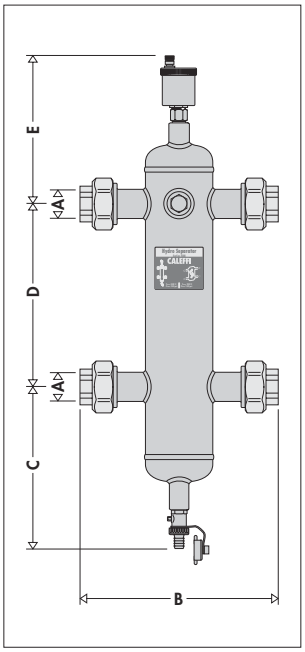
External cover

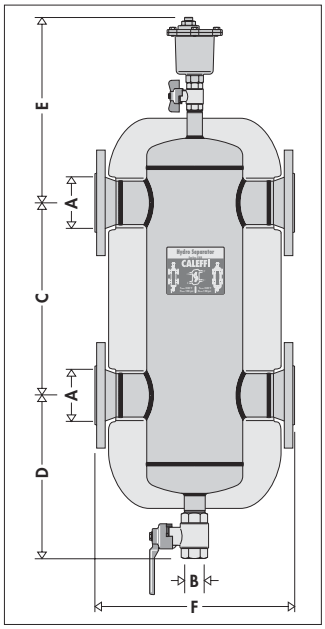
- Material: embossed aluminium
- Thickness: 7.0-mil (0,7 mm)
- Fire resistance (DIN 4102): Class 1

Head covers

- Heat moulded material: PS

Dimensions





Code	A	B	C	D	E	Weight (lb)
548006A	1"	8 7/8"	7 5/8"	6 5/8"	8"	7.5
548007A	1 1/4"	9 3/4"	8 7/8"	9 1/2"	8 1/2"	8.3
548008A	1 1/2"	11 1/8"	9 1/4"	10 1/4"	8 7/8"	12.5

Code	A	B	C	D	E	F	Weight (lb)
548050/2A	2"	1 1/4"	13"	9 1/2"	15 1/2"	14"	73
548060/2A	2 1/2"	1 1/4"	13"	9 1/2"	15 1/2"	14"	79
548080/2A	3"	1 1/4"	18"	15"	17"	18"	108
548100/2A	4"	1 1/4"	18"	15"	17"	18"	117

Size	1"	1 1/4"	1 1/2"	DN 50	DN 65	DN 80	DN 100
Volume (gal)	0.5	0.7	1.3	4	4	8	8

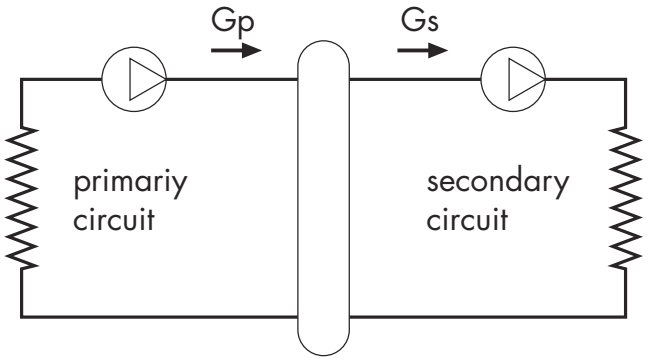
Operating principle

When a single system contains a primary production circuit, with its own pump, and a secondary user circuit, with one or more distribution pumps, operating conditions may arise in the system whereby the pumps interact, creating abnormal variations in circuit flow rates and pressures.

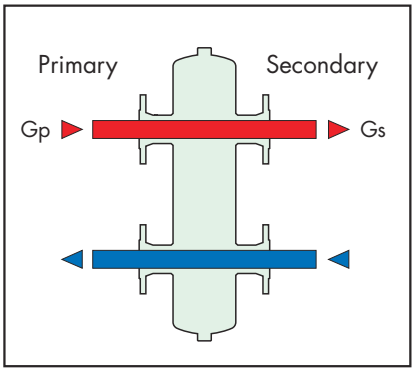
The hydronic separator creates a zone with a low pressure loss, which enables the primary and secondary circuits connected to it to be hydronically independent of each other; **the flow in one circuit does not create a flow in the other if the pressure loss in the common section is negligible.**

In this case, the flow rate in the respective circuits depends exclusively on the flow rate characteristics of the pumps, preventing reciprocal influence caused by connection in series.
Therefore, using a device with these characteristics means that the flow in the secondary circuit only circulates when the relevant pump is on, permitting the system to meet the specific load requirements at that time. When the secondary pump is off, there is no circulation in the secondary circuit; the whole flow rate produced by the primary pump is by-passed through the separator.

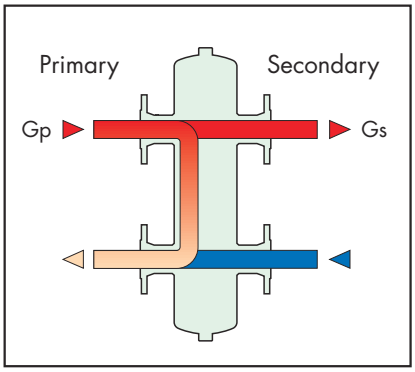
With the hydronic separator, it is thus possible to have a production circuit with a constant flow rate and a distribution circuit with a variable flow rate; these operating conditions are typical of modern heating and air-conditioning systems.



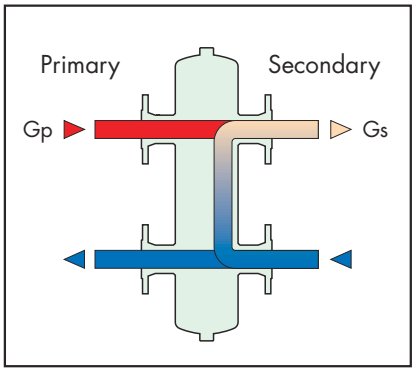
Three possible hydronic balance situations are shown below.



Gprimary = **G**secondary

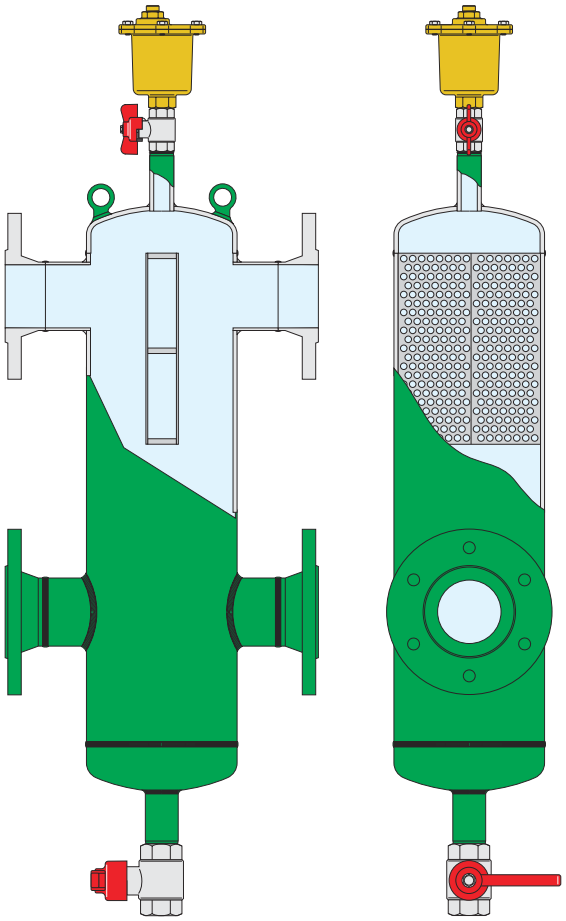


Gprimary > **G**secondary



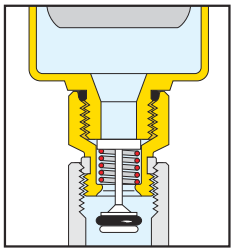
Gprimary < **G**secondary

Constructional details



Isolating the air vent valve

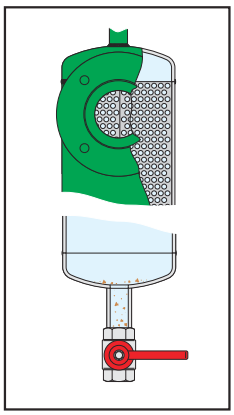
In flanged separators, the air vent is isolated manually, using a shut-off ball valve. In threaded separators, however, the air vent body is automatically isolated by the built-in valve, which closes when the air vent body is removed.



Dirt removing element

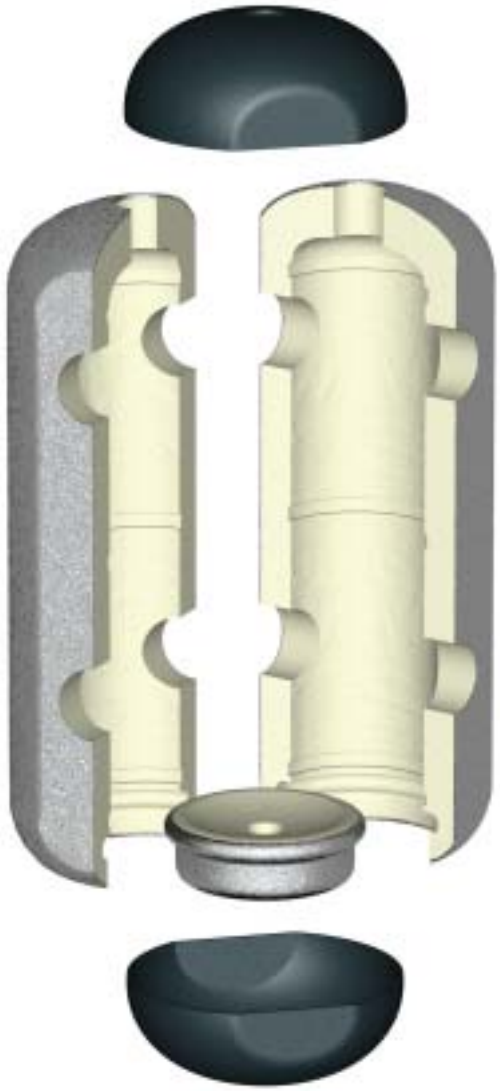
A vital function of the hydronic separator is carried out by the dirt removing element inside the device.
This makes is possible to separate and collect any impurities which may be present in the system.

These impurities are removed by means of the drain valve, which can be connected to a discharge pipe.



Insulation

The flanged separators are available complete with a hot pre-formed insulation shell. The presence of the outer aluminium cover also makes the separator completely sealed, even preventing water vapour entering from outside. For these reasons, this type of insulation can also be used in chilled water circuits, as it prevents the formation of condensate on the surface of the valve body.



Hydronic characteristics

The hydronic separator should be sized according to the maximum flow rate value at the inlet. The selected design value must be the greatest between the primary circuit and the secondary circuit.

	THREADED			FLANGED			
Size	**1”**	**1 1/4”**	**1 1/2”**	**2”**	**2 1/2”**	**3”**	**4”**
gpm	11	18	26	40	80	124	247
m³/h	2,5	4	6	9	18	28	56

SELECTIONS □ SNOW MELT

FlatPlate heat exchangers are very cost effective in Snow Melt applications and provide high output, fast response and separation of the fluids. Used for Boiler water to Glycol heat transfer, and in some applications, zone isolation, the FP Series provides an easy solution to Snow Melt systems.

Typical Snow Melt systems are Boiler Water to Glycol 10% to 40% (typical) depending upon location and weather conditions, with the heat exchanger providing isolation of the glycol from the boiler water, providing an oxygen barrier to the boiler and protecting other components in the boiler system.

To Select a Heat Exchanger for a Snow Melt application:

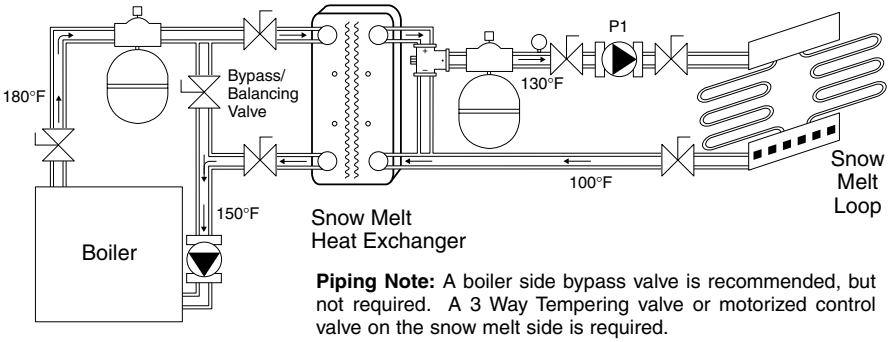
Step 1 Determine the Total BTUH required (from guidance from your Radiant Tube supplier) for the Snow Melt system.

Step 2 Select the appropriate FP Model from the table, based on the Total BTUH required.

If the Boiler water temperature is 180˚F or higher, or steam, use the Table shown. If the Boiler water temperature is less than 180˚F Contact your local FlatPlate Representative.

Step 3 Check the total GPM required. If the GPM requirement of the snow melt system is greater than the GPM listed in the selection table, select a larger model to match the GPM and pressure drop needs, or install a Bypass balancing valve. This will allow full flow and optimum pressure drop for the pump. This applies to the GPM (s) on both Boiler and Glycol sides.

For Example: For a snow melt system requiring a 122,000 BTUH, from the Table, Model FP5x12-16 (3/4" MPT) would be selected. If the GPM requirement is greater than 8.6 use the next larger model to match the pump requirement.



Piping Note: A boiler side bypass valve is recommended, but not required. A 3 Way Tempering valve or motorized control valve on the snow melt side is required.

Controls: . A 3 Way Tempering Valve is required to allow for adjustment of the snow melt side, and to limit the temperature of the glycol. For radiant tubing in sand maximum glycol temperature is 140˚F. In asphalt and concrete, maximum temperature is typically 150˚F. Recommended set point 130˚F for the glycol snow melt side.

Start-up: Adjust the 3 Way tempering valve to 130˚F or the desired set point.

For Snow Melt Application 100˚F In-130˚F Out (40% P.G.)
Connected to Boiler 180˚F Supply - 150˚F Return

Model	BTUH	Side A Boiler		Side B Snow Melt Circuit	
		GPM	PD (psi)	GPM	PD (psi)
FP5X12L-6 (3/4" MPT)	20,000	1.3	0.2	1.4	0.1
FP5X12L-6 (3/4" MPT)	30,000	2.0	0.6	2.1	0.3
FP5X12L-6 (3/4" MPT)	40,000	2.7	1.0	2.8	0.6
FP5X12L-8 (3/4" MPT)	50,000	3.4	0.7	3.6	0.5
FP5X12L-8 (3/4" MPT)	60,000	4.1	1.0	4.3	0.7
FP5X12-10 (3/4" MPT)	70,000	4.8	1.2	5.0	0.8
FP5X12-10 (3/4" MPT)	80,000	5.5	1.6	5.7	1.2
FP5X12-12 (3/4" MPT)	90,000	6.2	2.9	6.4	2.9
FP5X12-14 (3/4" MPT)	100,000	6.8	2.6	7.2	2.7
FP5X12-16 (3/4" MPT)	125,000	8.6	2.9	9.0	3.1
FP5X12-20 (1" MPT)	150,000	10.3	2.6	10.8	2.9
FP5X12-24 (1" MPT)	175,000	12.0	2.4	12.6	2.8
FP5X12-24 (1" MPT)	200,000	13.7	3.1	14.4	3.6
FP5X12-30 (1" MPT)	225,000	15.5	2.5	16.2	3.1
FP5X12-36 (1" MPT)	250,000	17.2	2.2	18.0	2.7
FP5X12-36 (1" MPT)	275,000	18.9	2.6	19.8	3.2
FP5X12-40 (1-1/4" MPT)	300,000	20.6	2.6	21.6	3.2
FP5X12-50 (1-1/4" MPT)	350,000	24.1	2.4	25.2	3.0
FP5X12-50 (1-1/4" MPT)	400,000	27.5	3.0	28.8	3.8
FP5X12-60 (1-1/4" MPT)	450,000	31.0	2.9	32.4	3.6
FP5X12-70 (1-1/4" MPT)	500,000	34.4	2.8	36.1	3.6
FP10X20-30 (1-1/2" MPT)	400,000	27.5	3.1	28.8	3.7
FP10X20-30 (1-1/2" MPT)	450,000	31.0	3.8	32.4	4.6
FP10X20-36 (1-1/2" MPT)	500,000	32.8	3.0	35.6	3.9
FP10X20-40 (1-1/2" MPT)	600,000	41.3	3.7	43.3	4.6
FP10X20-50 (2" MPT)	700,000	48.2	3.3	50.5	4.2
FP10X20-60 (2" MPT)	800,000	55.1	3.0	57.7	3.9
FP10X20-60 (2" MPT)	900,000	62.0	3.8	64.9	4.8
FP10X20-70 (2" MPT)	1,000,000	68.8	3.5	72.2	4.5

1. Larger models available. Contact your local FlatPlate representative.
2. For 200˚F Boiler Water, use the above chart. For 160˚F Boiler Water, multiply model number by 1.66.
3. For Steam use the above chart, substituting MP Model #.

SELECTIONS – SWIMMING POOLS & SPAS

Selecting a FlatPlate Heat Exchanger for Swimming Pool Applications is quick and easy, based on the Total Pool Capacity (gallons), Heat Loss of the pool and the Heat Up Rate desired. FlatPlate's MP Marine Series is designed for Swimming Pool applications where chemically treated water and biological elements are present.

Note: MP Series Heat Exchangers use a special Marine Stainless Alloy and MUST be used in pool environments. Materials such as 316 Stainless steel will corrode and fail due to chlorine, and other chemical and biological elements typical in pool water.

Swimming Pools

To select a Heat Exchanger for Boiler to Pool Water Heating:

Step 1 Select the Heat Up Rate Desired

Pool Use	Heat Up Rate
Periodic Use Only (weekends, holidays)	2˚F/hour
Extended Use (summer season)	1˚F/hour

Step 2 Determine Pool Capacity

Rectangular Pools

Capacity (gallons) = _____Length (ft) x _____Width (ft) x _____Average Depth (ft) x 7.5 gallons/cu ft

Circular Pools

Capacity (gallons) = _____Diameter^2 (ft) x _____Avg Depth (ft) x .785 x 7.5 gallons/cu ft

	1˚F/Hr Heat up Rate			2˚F/Hr Heat up Rate		
Pool Capacity (Gallons)	Boiler Output Required (BTUH)	Boiler Side Minimum GPM	**FlatPlate Model**	Boiler Output Required (BTUH)	Boiler Pump Minimum GPM	**FlatPlate Model**
1,000	8,345	2	**MP5x12-4 (1" MPT)**	16,690	2	**MP5x12-4 (1" MPT)**
2,000	16,690	2	**MP5x12-4 (1" MPT)**	33,380	2	**MP5x12-6 (1" MPT)**
4,000	33,380	2	**MP5x12-6 (1" MPT)**	66,760	4	**MP5x12-8 (1" MPT)**
6,000	50,070	3	**MP5x12-6 (1" MPT)**	100,140	7	**MP5x12-10 (1" MPT)**
8,000	66,760	4	**MP5x12-8 (1" MPT)**	133,520	9	**MP5x12-10 (1" MPT)**
10,000	83,450	6	**MP5x12-8 (1" MPT)**	166,900	11	**MP5x12-16 (1" MPT)**
12,000	100,140	7	**MP5x12-10 (1" MPT)**	200,280	13	**MP5x12-16 (1" MPT)**
15,000	125,175	8	**MP5x12-10 (1" MPT)**	250,350	17	**MP5x12-20 (1-1/4" MPT)**
20,000	166,900	11	**MP5x12-16 (1" MPT)**	333,800	22	**MP5x12-24 (1-1/4" MPT)**
25,000	208,625	14	**MP5x12-16 (1" MPT)**	417,250	28	**MP5x12-30 (1-1/4" MPT)**
30,000	250,350	17	**MP5x12-20 (1-1/4" MPT)**	500,700	33	**MP5x12-40 (1-1/4" MPT)**
35,000	292,075	18	**MP5x12-20 (1-1/4" MPT)**	584,150	36	**MP5x12-40 (1-1/4" MPT)**
40,000	333,800	19	**MP5x12-24 (1-1/4" MPT)**	667,600	38	**MP5x12-50 (1-1/4" MPT)**
45,000	375,525	21	**MP5x12-30 (1-1/4" MPT)**	751,050	43	**MP5x12-50 (1-1/4" MPT)**
50,000	417,250	24	**MP5x12-30 (1-1/4" MPT)**	834,500	48	**MP5x12-60 (1-1/4" MPT)**
60,000	500,700	29	**MP5x12-40 (1-1/4" MPT)**	1,001,400	57	**MP5x12-70 (1-1/4" MPT)**
70,000	584,150	33	**MP5x12-40 (1-1/4" MPT)**	1,168,300	67	**MP5x12-80 (1-1/4" MPT)**
80,000	667,600	38	**MP5x12-50 (1-1/4" MPT)**	1,335,200	76	**MP5x12-90 (1-1/4" MPT)**
90,000	751,050	43	**MP5x12-50 (1-1/4" MPT)**	1,502,100	86	**MP5x12-100 (1-1/4" MPT)**
100,000	834,500	48	**MP5x12-60 (1-1/4" MPT)**	1,669,000	95	**MP5x12-110 (1-1/4" MPT)**
125,000	1,043,125	60	**MP5x12-70 (1-1/4" MPT)**	2,086,250	119	**(2) MP5x12-70 (1-1/4" MPT)**
150,000	1,251,750	72	**MP5x12-80 (1-1/4" MPT)**	2,503,500	143	**(2) MP5x12-80 (1-1/4" MPT)**
175,000	1,460,375	83	**MP5x12-100 (1-1/4" MPT)**	2,920,750	167	**(2) MP5x12-100 (1-1/4" MPT)**
200,000	1,669,000	95	**MP5x12-110 (1-1/4" MPT)**	3,338,000	191	**(2) MP5x12-110 (1-1/4" MPT)**

1. Typical Design Conditions: 180˚F Boiler Water to HX, 80˚F Pool Water.
2. For 160˚F Boiler Water, multiply product model by 1.5 to select larger required model. (ie, FP5x12-16 at 180˚F, use FP5x12-24 at 160˚F).
3. For 200˚F Boiler Water and Steam, use model number shown for 180˚F. Multipy minimum Boiler gpm by .60.
4. Bypass/Balancing valve on Pool side of HXREQUIRED to allow for full pool pump flow from 30 to 100 gpm or more.
5. Pool side Pressure drop for all models ranges for typical flow with bypass/balancing valve 4.0 psi or higher.
6. Boiler side Pressure drop for all models ranges 4.0 psi to 4.5 psi for the above Minimum Flow rates.

SELECTIONS – SWIMMING POOLS & SPAS

Step 3 Select the Heat Exchanger and Boiler Output Required

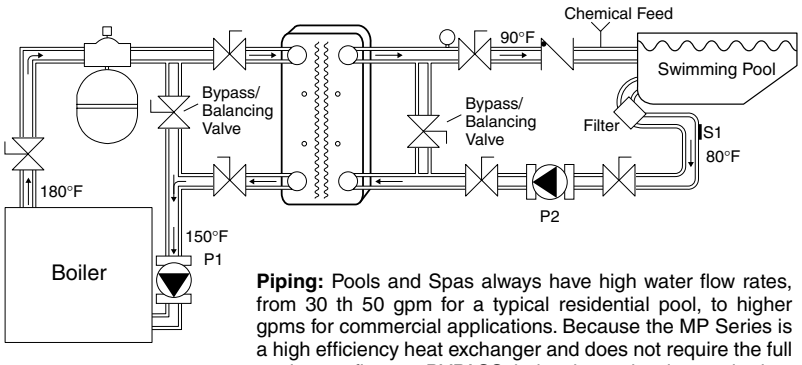
From the Selection table, based on the Pool Capacity (gallons) select the appropriate heat exchanger and boiler capacity based on the Heat Up Rate.

For Example: For a 15x30 ft pool, averaging 5.5 ft deep, the pool capacity is 24,475 gallons. Using the Selection table, a 1˚F/hr heat up rate, requires 208,625 BTUH and a MP5x12-16 heat exchanger.

Step 4 Check for Heat Loss to surroundings

Heat Loss (BTUH) = 12 x _____Pool Surface Area (sq ft) x _____(Desired Pool Temp(˚F) – _____Coldest Ambient Temp During Use (˚F))

Use this calculation to verify that the Boiler output exceeds the heat loss to surroundings.



Piping: Pools and Spas always have high water flow rates, from 30 th 50 gpm for a typical residential pool, to higher gpms for commercial applications. Because the MP Series is a high efficiency heat exchanger and does not require the full pool gpm flow, a BYPASS balancing valve is required to bypass 50% to 80% of the pool water. This bypass/balancing valve should be adjusted and permanently set at start-up.

Chemical feeds MUST be down stream from the heat exchanger, and a check valve should also be installed to prevent back-flow of chemicals into the heat exchanger when the pump is not in operation.

Controls: Temperature control of the pool should be based on a return water temperature stat, controlling (on/off) the boiler and boiler pump. Temperature control of the 90-100˚F feed to the pool should be controlled by permanent adjustment of the bypass valve.

Startup: Start up the system, and adjust the pool side bypass valve so that the pool heats up no faster then 2˚F/hr, initially. After the pool reaches approximately 78-80˚F, and the boiler water is entering at 180˚F, adjust the pool side bypass/balancing valve to obtain 90˚F to 100˚F water to the pool. Then adjust the boiler bypass/balancing valve so that approximately 150˚F water is being returned to the boiler.

Spas

To select a MP Series Heat Exchanger for a Spa:

Step 1 Determine the Capacity (gallons) of the Spa or Hot Tub. (See Step 2 in Pool calculations)

Step 2 From the Spa selection table, based on the Spa Capacity (gallons) select the appropriate heat exchanger and boiler capacity based on the Heat Up Rate.

Note: A spa is typically operated at 100˚F to 105˚F, requires a faster heat up rate, and due to aeration, has a higher loss to ambient surroundings. The above table is based on 3F/hr plus ambient losses due to aeration.

2˚F/Hr Heat up Rate, plus Aeration			
Spa Capacity Gallons	Boiler Output Required (BTUH)	Boiler Side Minimum GPM	**FlatPlate Model**
750	31,300	2	**MP5x12-6 (1" MPT)**
1,000	41,725	3	**MP5x12-8 (1" MPT)**
1,500	62,588	4	**MP5x12-10 (1" MPT)**
2,000	83,450	6	**MP5x12-16 (1" MPT)**
4,000	166,900	11	**MP5x12-20 (1-1/4" MPT)**
6,000	250,350	17	**MP5x12-30 (1-1/4" MPT)**
8,000	333,800	22	**MP5x12-40 (1-1/4" MPT)**

1. Typical Design Conditions: 180˚F Boiler Water to HX, 105˚F Spa Water.
2. For 160˚F Boiler Water, multiply product model by 1.5 to select larger required model. (ie, FP5x12-16 at 180˚F, use FP5x12-24 at 160˚F).
3. For 200˚F Boiler Water and Steam, use model number shown for 180˚F.
4. Bypass/Balancing valve on SPA side of HX REQUIRED to allow for full spa pump flow of 20 to 60 gpm.
5. Use individual HX's for each SPA.

SELECTIONS – RADIANT FLOOR

Connected to Boiler: 180˚F Supply, 150˚F Return

Model	Radiant Floor 80˚F return, 100˚F supply			Radiant Floor 100˚F return, 120˚F supply			Radiant Floor 120˚F return, 140˚F supply		
	BTUH	Side A Boiler	Side B Radiant Floor GPM	BTUH	Side A Boiler	Side B Radiant Floor GPM	BTUH	Side A Boiler	Side B Radiant Floor GPM
FP5x12L-4 (3/4" MPT)	24,000	1.6	1.6	24,000	1.6	2.4	21,000	1.4	2.1
FP5x12L-6 (3/4" MPT)	40,000	2.7	4.0	32,000	2.1	3.2	28,000	1.9	2.8
FP5x12L-6 (3/4" MPT)	60,000	4.0	6.0	48,000	3.2	4.8	42,000	2.8	4.2
FP5x12L-8 (3/4" MPT)	75,000	5.0	7.5	64,000	4.3	6.4	56,000	3.7	5.6
FP5x12-10 (3/4" MPT)	80,000	5.3	8.0	70,000	4.7	7.0	50,000	3.3	5.0
FP5x12-10 (3/4" MPT)	96,000	6.4	9.6	84,000	5.6	8.4	60,000	4.0	6.0
FP5x12-12 (3/4" MPT)	112,000	7.5	11.2	98,000	6.5	9.8	70,000	4.7	7.0
FP5x12-12 (3/4" MPT)	128,000	8.5	12.8	112,000	7.5	11.2	80,000	5.3	8.0
FP5x12-14 (3/4" MPT)	144,000	9.6	14.4	126,000	8.4	12.6	90,000	6.0	9.0
FP5x12-14 (3/4" MPT)	160,000	10.7	16.0	140,000	9.3	14.0	100,000	6.7	10.0
FP5x12-20 (1" MPT)	200,000	13.3	20.0	175,000	11.7	17.5	125,000	8.3	12.5
FP5x12-24 (1" MPT)	240,000	16.0	24.0	210,000	14.0	21.0	150,000	10.0	15.0
FP5x12-30 (1" MPT)	280,000	18.7	28.0	245,000	16.3	24.5	175,000	11.7	17.5
FP5x12-30 (1-1/4" MPT)	320,000	21.3	32.0	280,000	18.7	28.0	200,000	13.3	20.0
FP5x12-36 (1" MPT)	400,000	26.7	40.0	350,000	23.3	35.0	250,000	16.7	25.0
FP5x12-40 (1-1/4" MPT)	440,000	29.3	44.0	385,000	25.7	38.5	275,000	18.3	27.5
FP5x12-50 (1-1/4" MPT)	480,000	32.0	48.0	420,000	28.0	42.0	300,000	20.0	30.0
FP5x12-50 (1-1/4" MPT)	560,000	37.3	56.0	490,000	32.7	49.0	350,000	23.3	35.0
FP5x12-60 (1-1/4" MPT)	640,000	42.7	64.0	560,000	37.3	56.0	400,000	26.7	40.0
FP5x12-70 (1-1/4" MPT)	720,000	48.0	72.0	630,000	42.0	63.0	450,000	30.0	45.0
FP5x12-80 (1-1/4" MPT)	800,000	53.3	80.0	700,000	46.7	70.0	500,000	33.3	50.0
FP10x20-20 (1-1/2" MPT)	640,000	42.7	64.0	560,000	37.3	56.0	400,000	26.7	40.0
FP10x20-24 (1-1/2" MPT)	800,000	53.3	80.0	700,000	46.7	70.0	500,000	33.3	50.0
FP10x20-30 (1-1/2" MPT)	960,000	64.0	96.0	840,000	56.0	84.0	600,000	40.0	60.0
FP10x20-36 (1-1/2" MPT)	1,120,000	74.7	112.0	980,000	65.3	98.0	700,000	46.7	70.0
FP10x20-40 (1-1/2" MPT)	1,280,000	85.3	128.0	1,120,000	74.7	112.0	800,000	53.3	80.0
FP10x20-50 (2" MPT)	1,600,000	106.7	160.0	1,400,000	93.3	140.0	1,000,000	66.7	100.0
FP10x20-60 (2" MPT)	1,920,000	128.0	192.0	1,680,000	112.0	168.0	1,200,000	80.0	120.0

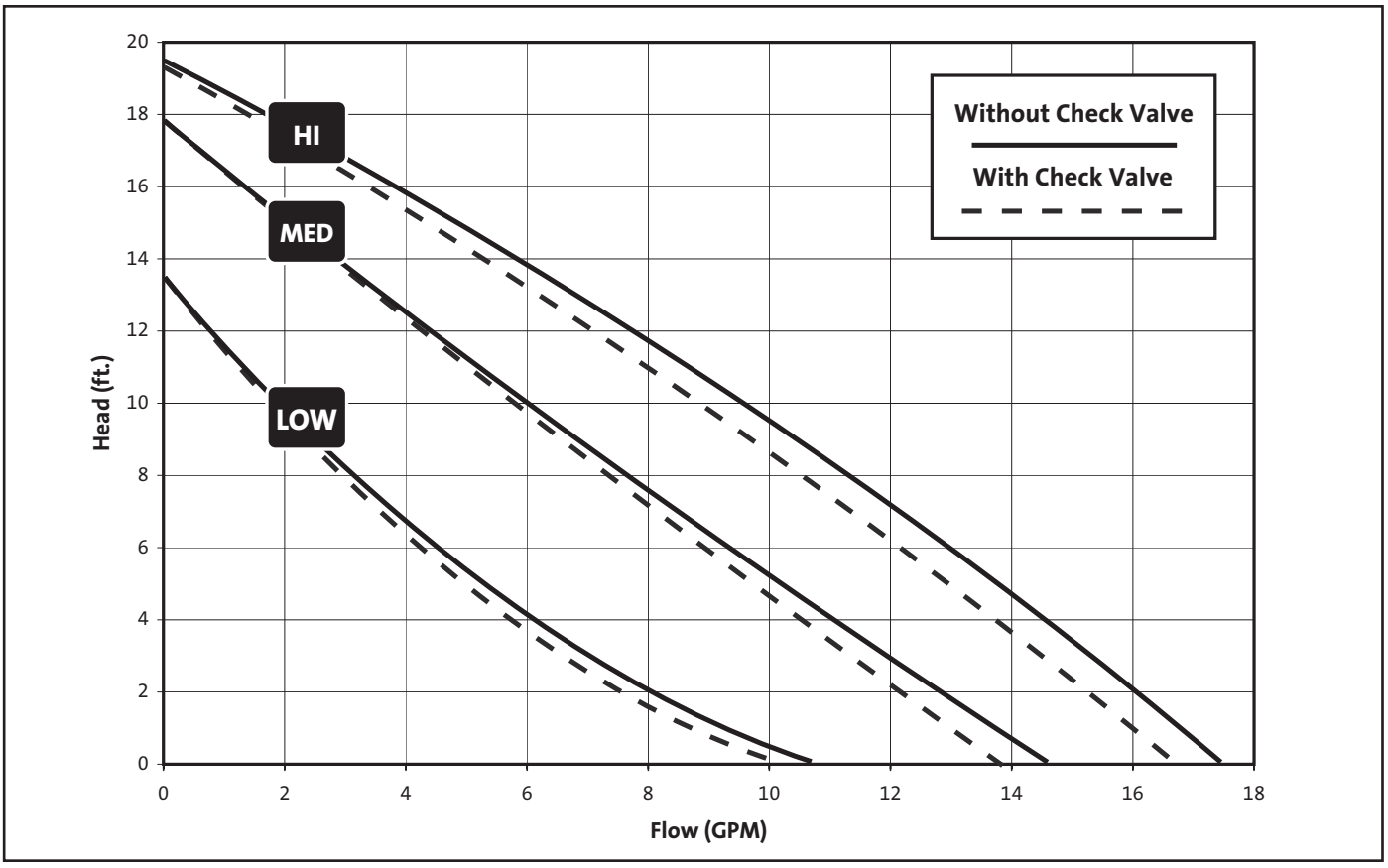
Larger models available.

Connected to a Hot Water Heater: 130˚F Supply, 110 Return

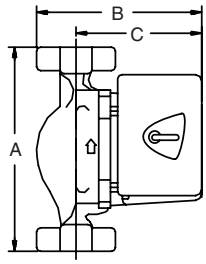
Model	Radiant Floor 80˚F return, 100˚F Supply			Radiant Floor 100˚F return, 120˚F Supply		
	BTUH	Side A Hot Water Heater GPM	Side B Radiant Floor GPM	BTUH	Side A Hot Water Heater GPM	Side B Radiant Floor GPM
FP5x12L-4(3/4" MPT)	12,000	1.2	1.2	3,000	0.3	0.3
FP5x12L-6(3/4" MPT)	24,000	2.4	2.4	6,000	0.6	0.6
FP5x12L-8(3/4" MPT)	36,000	3.6	3.6	8,000	0.8	0.8
FP5x12L-8(3/4" MPT)	44,000	4.4	4.4	10,000	1.0	1.0
FP5x12-10(3/4" MPT)	50,000	5.0	5.0	15,000	1.5	1.5
FP5x12-12(3/4" MPT)	60,000	6.0	6.0	18,000	1.8	1.8
FP5x12-14(3/4" MPT)	72,000	7.2	7.2	23,000	2.3	2.3
FP5x12-16(1" MPT)	84,000	8.4	8.4	28,000	2.8	2.8
FP5x12-20(1" MPT)	110,000	11.0	11.0	44,000	4.4	4.4
FP5x12-24(1" MPT)	134,000	13.4	13.4	56,000	5.6	5.6
FP5x12-30(1" MPT)	170,000	17.0	17.0	68,000	6.8	6.8
FP5x12-36(1" MPT)	207,000	20.7	20.7	77,000	7.7	7.7
FP5x12-40(1-1/4" MPT)	232,000	23.2	23.2	97,000	9.7	9.7
FP5x12-50(1-1/4" MPT)	293,000	29.3	29.3	117,000	11.7	11.7
FP5x12-60(1-1/4" MPT)	354,000	35.4	35.4	138,000	13.8	13.8
FP5x12-70(1-1/4" MPT)	415,000	41.5	41.5	158,000	15.8	15.8
FP5x12-80(1-1/4" MPT)	476,000	47.6	47.6	181,000	18.1	18.1

Larger models available.

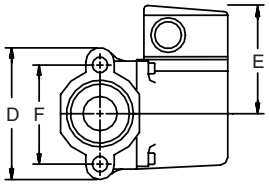
UPS 15-58FC/FRC SUPERBRUTE



Flow range: 0 - 17.5 U.S. GPM
Head range: 0 - 19 FEET
Motors: 2 Pole, Single Phase
Maximum fluid temperature: 230°F (110°C)
Min. fluid temperature: 36°F (2°C)
Maximum working pressure: 145 PSI

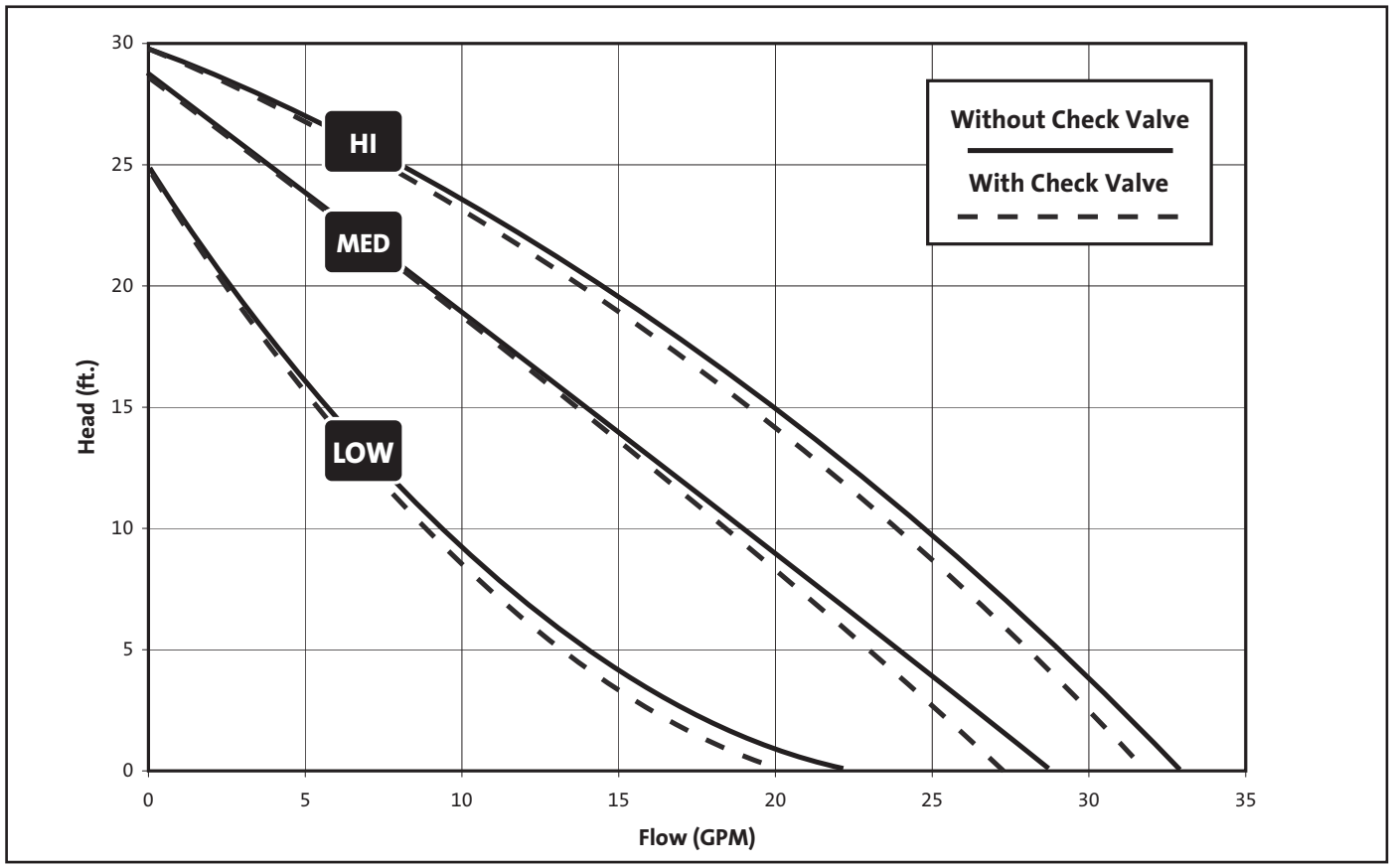


UPS15-58FC/FRC		AMPS	WATTS	HP	CAPACITOR
115V	Spd. 3	0.75	87	1/25	10mF/180V
	Spd. 2	0.66	80	1/25	10mF/180V
	Spd. 1	0.55	60	1/25	10mF/180V

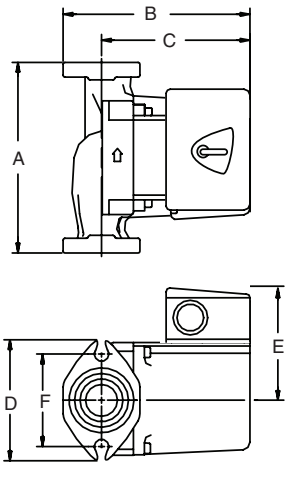


Model Type	A	B	C	D	E	F	Connection Type and Size	Shipping Wt. (Lbs.)
UPS15-58FC/FRC	6 1/2	5 1/4	4	4 3/16	3	3 5/32	GF 15/26 Flange – (2) 1/2" Dia. Bolt Holes	7 1/4

UPS 26-99FC/BFC SUPERBRUTE



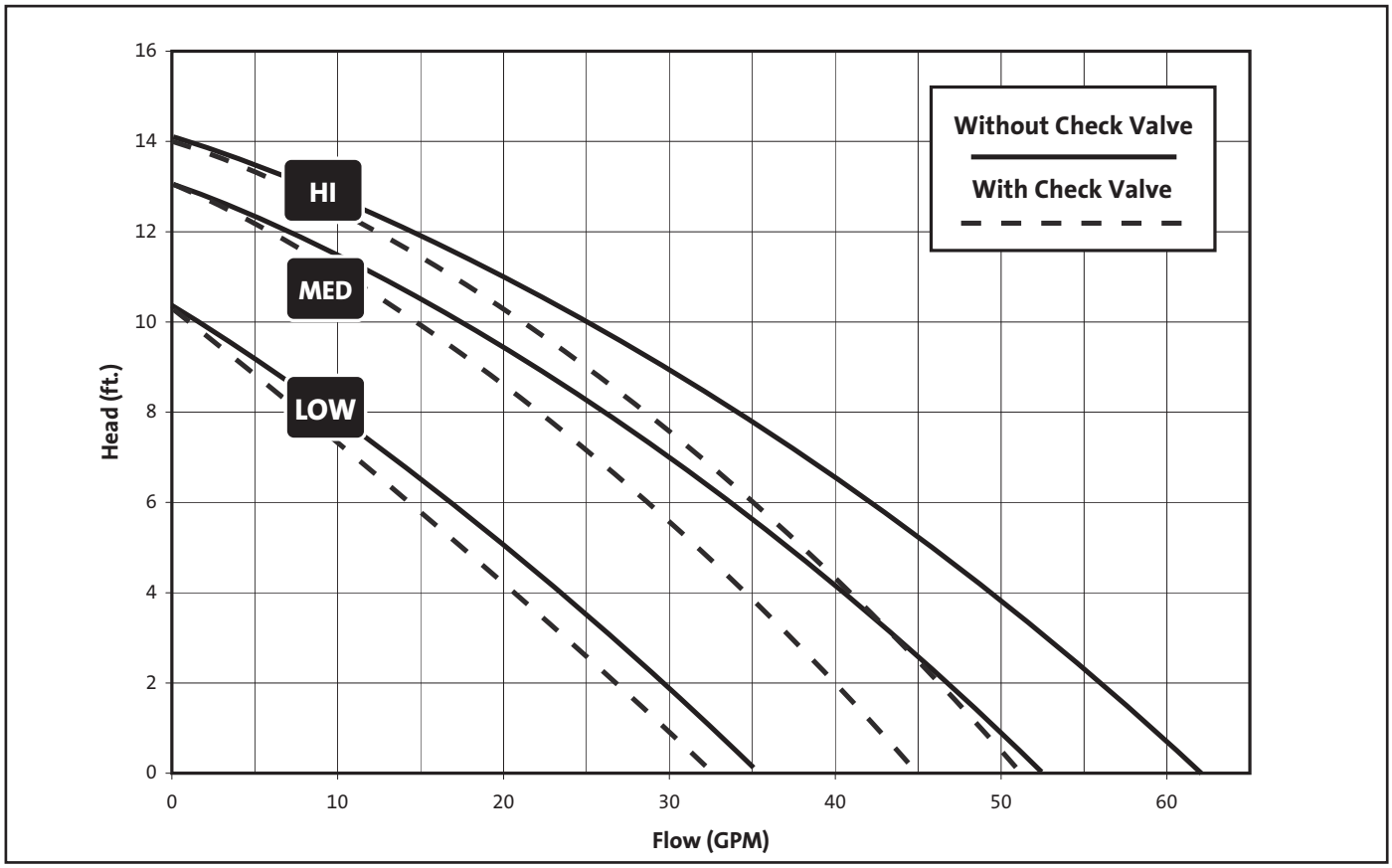
Flow range: 0 - 34 U.S. GPM
Head range: 0 - 30 FEET
Motors: 2 Pole, Single Phase
Maximum fluid temperature: 230°F (110°C)
Min. fluid temperature: 36°F (2°C)
Maximum working pressure: 145 PSI



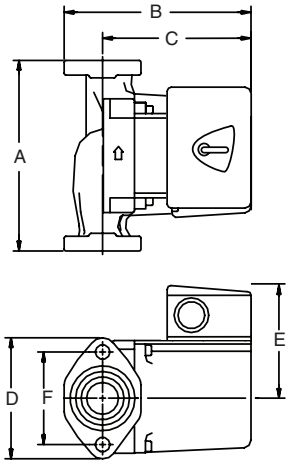
MODEL	VOLTS	AMPS	WATTS	HP	CAPACITOR
115V	Spd. 3	1.8	197	1/6	20mF/180V
	Spd. 2	1.5	179	1/6	20mF/180V
	Spd. 1	1.3	150	1/6	20mF/180V
230V	Spd. 3	0.9	196	1/6	5mF/400V
	Spd. 2	0.8	179	1/6	5mF/400V
	Spd. 1	0.7	150	1/6	5mF/400V

Model Type	A	B	C	D	E	F	Connection Type and Size	Approximate Shipping Wt. (lbs)
UPS26-99FC/BFC	6 1/2	6	4 7/8	3 1/2	3 7/16	3 5/32	GF 15/26 Flange - (2) 1/2" Dia. Bolt Holes	10.3

UPS 43-44FC/BFC SUPERBRUTE



Flow range: 0 - 64 U.S. GPM
Head range: 0 - 14 FEET
Motors: 2 Pole, Single Phase
Maximum fluid temperature: 230°F (110°C)
Min. fluid temperature: 32°F (0°C)
Maximum working pressure: 145 PSI



UPS43-44BFC/BFC		AMPS	WATTS	HP	CAPACITOR
115V	Spd. 3	1.8	203	1/6	20mF/180V
	Spd. 2	1.7	189	1/6	20mF/180V
	Spd. 1	1.4	157	1/6	20mF/180V
230V	Spd. 3	0.9	203	1/6	5mF/400V
	Spd. 2	0.8	190	1/6	5mF/400V
	Spd. 1	0.7	157	1/6	5mF/400V

Model Type	A	B	C	D	E	F	Connection Type and Size	Approximate Shipping Wt. (lbs)
UPS43-44FC/BFC	8 1/2	6 11/16	5 1/8	4 3/4	3 3/16	3 7/16	GF 40/43 Flange - (2) 1/2" Dia. Bolt Holes	13.6

Nontoxic/Noncorroding

HARVEY HEAT -100 ANTIFREEZE

INSTRUCTIONS:

1. Turn off water supply.
2. Drain water lines through faucets, petcocks and other outlets. Close all outlets once system has drained.
3. Refill system with Harvey Heat -100 (undiluted) from this container. Be sure to add amount according to capacity of piping. See Table I.
4. **For boats, trailers or recreational vehicles** with pressurized or electric pump water systems, follow Table II. Drain all water lines and supply tank completely and refill with Harvey Heat -100. Repressurize water supply system. Open all faucets one at a time to see if system is full. Close faucet when yellow color of Harvey Heat -100 begins to flow.
5. **Protect drains.** Be sure to add 1 quart or more of Harvey Heat -100 (undiluted) to traps and toilets to prevent freeze-up and to keep seals soft and pliable.
6. **For permanent protection of HVAC and solar heating/cooling systems,** Harvey Heat -100 may be left in the system all year. Concentration necessary for freeze protection depends on the system design. Consult with the manufacturer of the individual systems before using Harvey Heat products. Before charging any new or existing systems with Harvey Heat -100, they should be thoroughly cleaned and flushed.
7. **Other recommended uses for Harvey Heat -100** include protection of non-drainable fire hydrants; sprinkler systems; coolant in manufacture and processing of beef, wine, milk, and other liquids; in freezing of poultry, fish, and vegetables; and in freezer coil defrosting.
8. **To de-winterize water systems**–open all faucets, petcocks and other outlets and run fresh water through system until yellow color disappears. Continue to flush several times until only fresh water flows from faucets. Refill supply tank with fresh water.
9. Harvey Heat -100 is recommended to be used undiluted in most cases. However, it is also effective when mixed with water to provide freeze and burst protection. For other than maximum protection, see Table III.
10. Do not use in gasoline or diesel engines.

TABLE I - (Addition to system based on size of piping)

Pipe Diameter	1/2"	3/4"	1"	1-1/2"	2"	3"
Gallons Harvey Heat -100 per 100 ft. pipe	1.6	2.8	4.5	10.6	17.4	38.4

TABLE II - Boat and Trailer Guide

Size of Boat/Trailer	Add approximate quantity of Harvey Heat -100 to water tank
Under 18 ft.	2-3 gal.
18 ft.-23 ft.	3-4 gal.
23 ft. and over	4-5 gal.

TABLE III -

Concentration	# Parts of Harvey Heat -100	# Parts of Water	Freeze Protection	Burst Protection
100%	Undiluted	0	-60°F	-100°F
75%	3	1	-30°F	-80°F
50%	1	1	+3°F	-30°F

NOTE: Do not add more than 1 part water for every 1 part Harvey Heat -100 (50% dilution).

INGREDIENTS -

Name	CAS No.
Propylene Glycol	57-55-6
Water	7732-18-5
Dipotassium Phosphate	7758-11-4
HMIS: 1-1-0	

Part No. 016850

WARNING: KEEP OUT OF THE REACH OF CHILDREN. DO NOT TAKE INTERNALLY.
For Emergency First Aid Help Call 1-303-623-5716 Collect

Manufactured by William H. Harvey Company, Omaha, NE 68117 Made in U.S.A. ©2005

Solves Hydronic System Cleaning Problem!

Hydro-Solv 9100™

Hydronic System Cleaner
for New and Used Systems

Solves System Fouling!

- Clean solder flux, cutting oil, rust and dirt from new systems.
- Remove scale and corrosion from older fouled systems!
- Recover lost operating efficiency!
- Lower heating bills!
- Removes corrosive bacteria!

Specially Formulated for Hydronic Systems

- Effectively cleans iron, copper, aluminum, brass and stainless.
- Safe on all Hydronic System Components when used as directed.
- Non-Hazardous
- Environmentally Friendly.
- Contains no acids or heavy metals.

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***"Be Professional** – Properly Clean The System"*

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Hydronic Treatment Product:

Solves Corrosion Problems!

PRO-TEK 922™

Rhomar Water Management, Inc has put twenty years of industrial water treatment experience into a high tech water treatment product specifically designed for Hydronic heating systems.

Due to the many different types of materials and metals used such as aluminum, copper and mild steel along with various flexible tubing, the need for a **complex formulated scale and corrosion inhibitor** was quite high.

PRO-TEK 922™ Hydronic treatment product provides all the following features & benefits:

- ☆ **Corrosion inhibitors for copper, brass, aluminum, iron, and steel.**
- ☆ **Helps control system pH.**
- ☆ **Safe on all standard flexible tubing.**
- ☆ **Compatible with propylene and ethylene glycol.**
- ☆ **Provides corrosion protection for glycol mixtures.**
- ☆ **Controls scale formation.**
- ☆ **Protects equipment during warranty periods.**
- ☆ **Maintains system efficiency.**
- ☆ **Reduces maintenance costs.**
- ☆ **Packaged in convenient 1gal. containers**
- ☆ **Provides many years of system protection.**
- ☆ **Non-Hazardous**
- ☆ **Environmentally friendly.**

Association of Water Technologies, Inc.

Rhomar Water Management, Inc.

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RPA Radiant Panel Association

PO BOX 229
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65801

TalkToUs@RhomarWater.com

PRO-TEK™ will give your customers better performances from their hydronic systems.

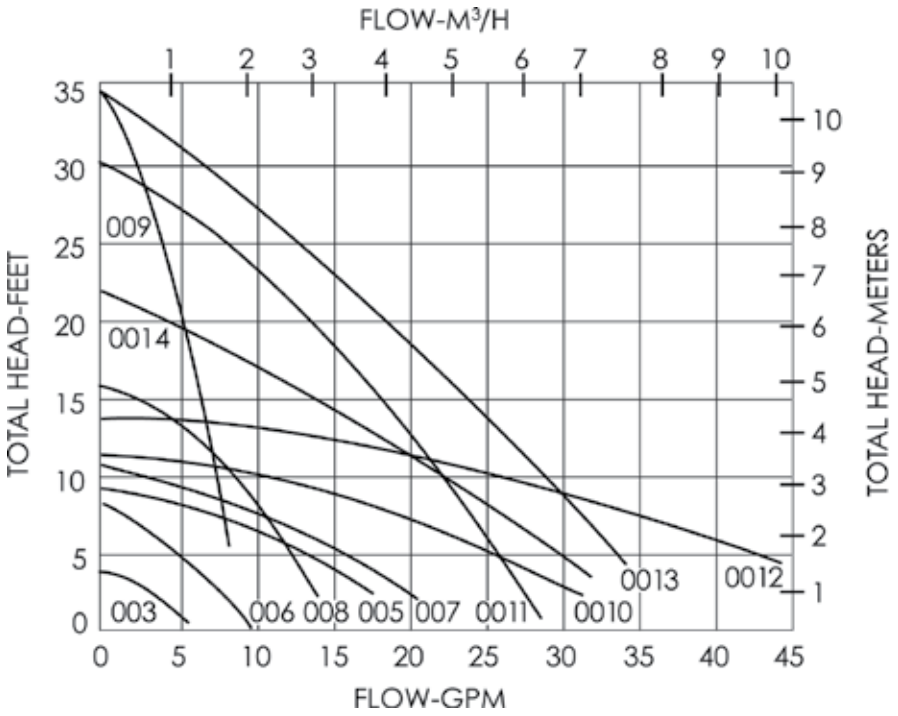
Please read the **Technical Data** on reverse side for additional information.

Contact **Rhomar Water Management, Inc** at **1-800-543-5975** for product ordering or questions.

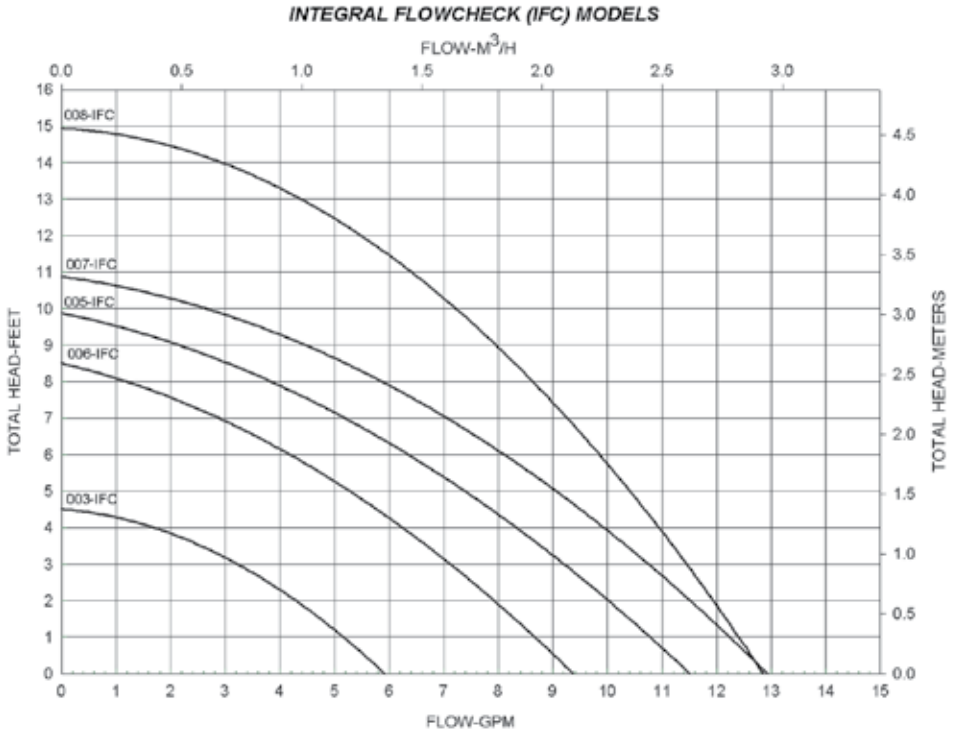
www.rhomarwater.com **e-mail: TalkToUs@rhomarwater.com**

Performance Field Information

60 Hz Performance Field



60 Hz Performance Field



i Series Mixing Valve

Taco iSeries Mixing Valves are a breakthrough in precision, cost effective temperature control for heating systems. Available in 2-way mixing or 3-way injection configurations, iSeries valves provide either outdoor reset control or fixed water supply temperature. Additionally, iSeries valves protect the boiler against flue gas condensation. A microprocessor-based control is built into the valve actuator, to which all wiring connections are made. All-in-one iSeries Mixing Valves deliver optimum zone-by-zone temperature control, with built-in boiler protection.

HYDRONIC COMPONENTS & SYSTEMS

Do it once.
Do it right.™ Taco®

©Taco Catalog # 100-19
Supersedes: New

Effective Date: 11/01/03
Printed in USA

Submittal Data Information

101-089

iSeries® Mixing Valve

Effective: April 1, 2006 **Supersedes:** August 15, 2005

Job: _____ Engineer: _____ Contractor: _____ Rep: _____

ITEM NO.	MODEL NO.	

iSeries Features

- 2-way Injection, 3-way or 4-way Mixing
- Operates Off Constant Power or Relay End Switch
- Ball Valve Design, High Cv
- Manual Operation Button
- Solid State Microprocessor Design
- Compact Design
- Easy, One-handed Actuator Removal
- 125 PSI Shutoff Pressure
- Plug-in Low Voltage Connections
- Multi-Status LED Indicator Light
- Fail Safe Mode
- Sensors Included

Additional Outdoor Reset Features

- Selectable Maximum Supply Temperature (110°F, 130°F, 150°F, or Off)
- Selectable Minimum Supply Temperature (85°F, when max. supply temp. is set to 150°F or Off)
- Adjustable Minimum Boiler Return Temperature (120°F, 135°F, or Off)
- Warm Weather Shutdown (70°F or Off)
- Adjustable Heating Curve (0.2-2.2 Reset Ratio)

Additional Setpoint Features

- Adjustable Setpoint Dial (80°F to 180°F)
- Selectable 15°F Setback
- Optional Boiler Protection (Set at 135°F)

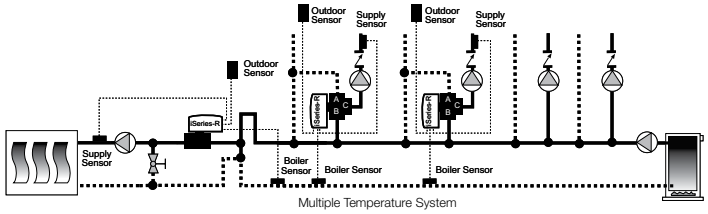
Specifications

Maximum Operating Pressure: 300 psi, (2,100 kPa)
Fluid Temperature Range: 20°F to 240°F (-7°C to 115°C) @ 135°F (57°C) ambient
Ambient Conditions: Indoor Use Only, -22°F to 185°F (-30°C to 85°C), < 90% Non-Condensing
Service: Closed Systems, Hot and Chilled Water, up to 50% Glycol
Seat Leakage: Drop-Tight Close Off
Power Supply: 24 VAC ±10% 50/60 HZ
Electrical Rating: 24 VAC, 60 HZ, 0.4 Amps.
Do not exceed number of valves per transformer rating.
Example: Do not use more than 4 valves per 40VA transformer
Sensors: NTC Thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) β=3892

Outdoor Reset Application:

Use the Taco Outdoor Reset iSeries Mixing Valves instead of a conventional injection system. With a full featured outdoor reset control built right into the actuator there is no need for an externally mounted reset control or expensive control valve. The iSeries valves can also be set up to do zone-by-zone outdoor reset, providing optimal comfort control for every zone.

The direct drive actuator modulates a 2-way, 3-way or 4-way valve that injects different rates of hot water, supplying virtually any water temperature to the heating system. Working off an adjustable reset ratio, the valve's maximum and minimum system supply temperatures can be adjusted to support all types of jobs, including staple-up radiant floors that require a higher starting temperature. The iSeries valves include an adjustable boiler protection function which prevents low water temperatures from returning to the boiler. With a multi-status LED indicator light, plug-in wiring connections and an easy to remove actuator, the installation could not be easier.

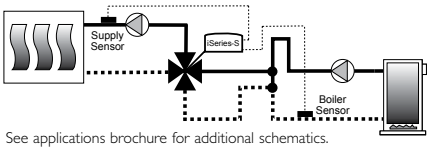


Multiple Temperature System

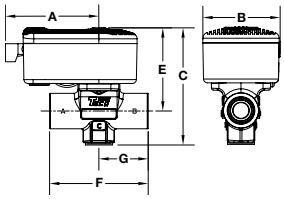
See applications brochure for additional schematics.

Setpoint Application:

Use the Taco Setpoint iSeries Mixing Valves instead of a thermostatic mixing valve for precise dial-in temperature control to a heating system. The direct drive actuator modulates a 2-way, 3-way or 4-way valve to inject different rates of hot water into the cooler system return water. In combination with the optional boiler protection sensor, the iSeries valves provide the unique benefit of optimal temperature control with boiler protection. The setpoint temperature is adjustable from 80°F to 180°F using a dial located on top of the actuator. A 15°F setback of the supply water can be initiated for additional unoccupied or nighttime setback control. An external multi-status LED indicator light, plug-in wiring connections and an easy to remove actuator makes installation and diagnostics a snap.



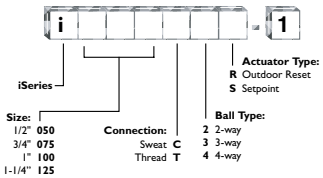
See applications brochure for additional schematics.



Dimensions

Valve Size	A	B	C			E		F		G		WEIGHT / Cv		
			2-way	3-way	4-way	2&3-way	4-way	2&3-way	4-way	2&3-way	4-way	2-way	3-way	4-way
1/2"	3"	2-3/8"	3-9/16"	4-9/16"	---	2-9/16"	---	3-1/8"	---	1-9/16"	---	1.15 lbs. / 4.9	1.25 lbs. / 1.5	---
3/4"	3"	2-3/8"	3-3/4"	4-7/8"	3-3/4"	2-5/8"	3-1/16"	3-1/8"	3-3/16"	1-9/16"	1-5/8"	1.20 lbs. / 10.3	1.32 lbs. / 3.3	1.80 lbs. / 7.0
1"	3"	2-3/8"	3-11/16"	5"	3-15/16"	2-5/8"	3-1/16"	3-1/8"	3-1/4"	1-9/16"	1-5/8"	1.55 lbs. / 8.9	1.75 lbs. / 3.0	1.25 lbs. / 9.3
1-1/4"	3"	2-3/8"	---	---	4-5/16"	---	3-5/16"	---	3-3/8"	---	1-11/16"	---	---	3.15 lbs. / 17.5

iSeries Ordering



Do it Once. Do it Right.

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Visit our website at: www.taco-hvac.com

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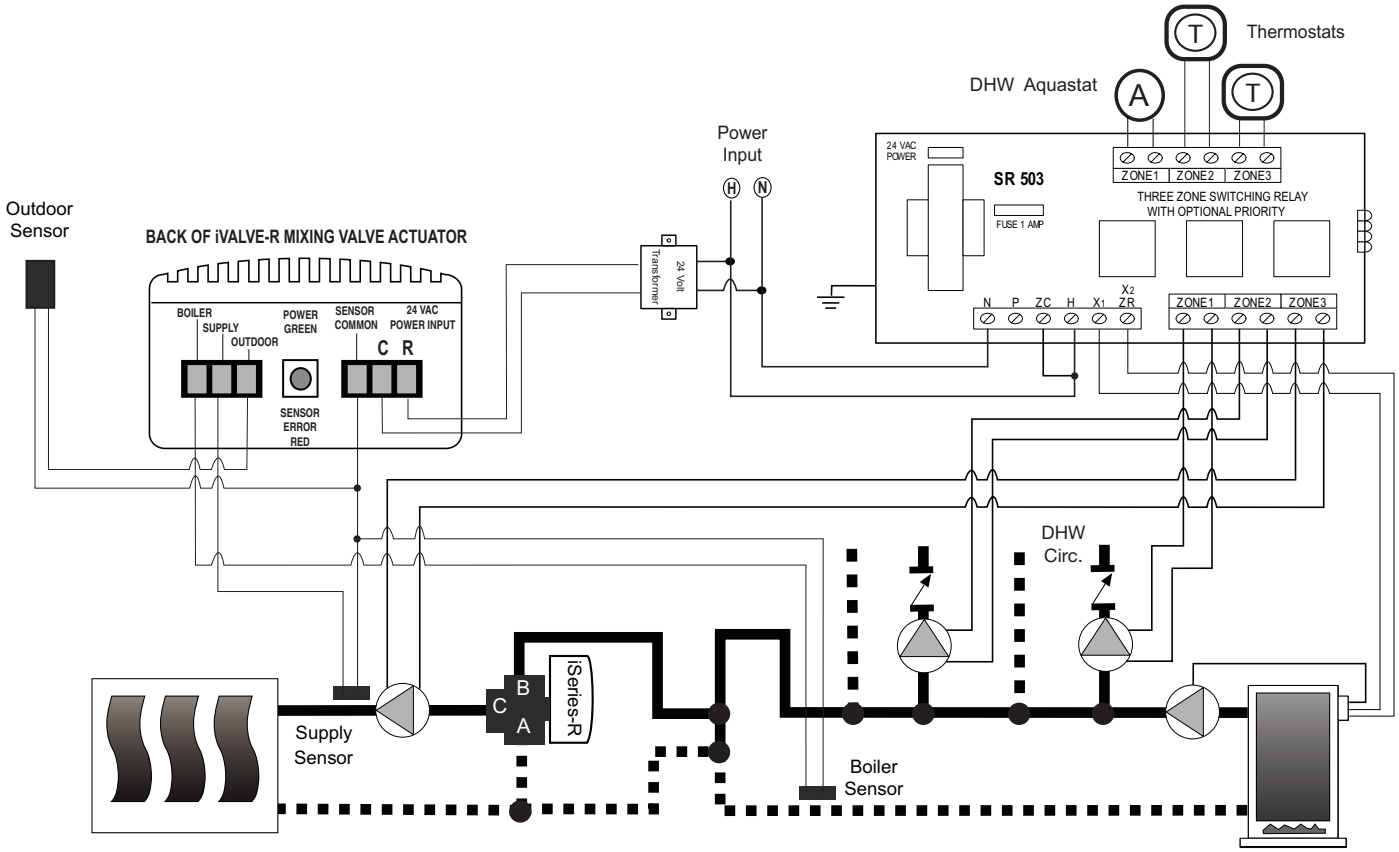
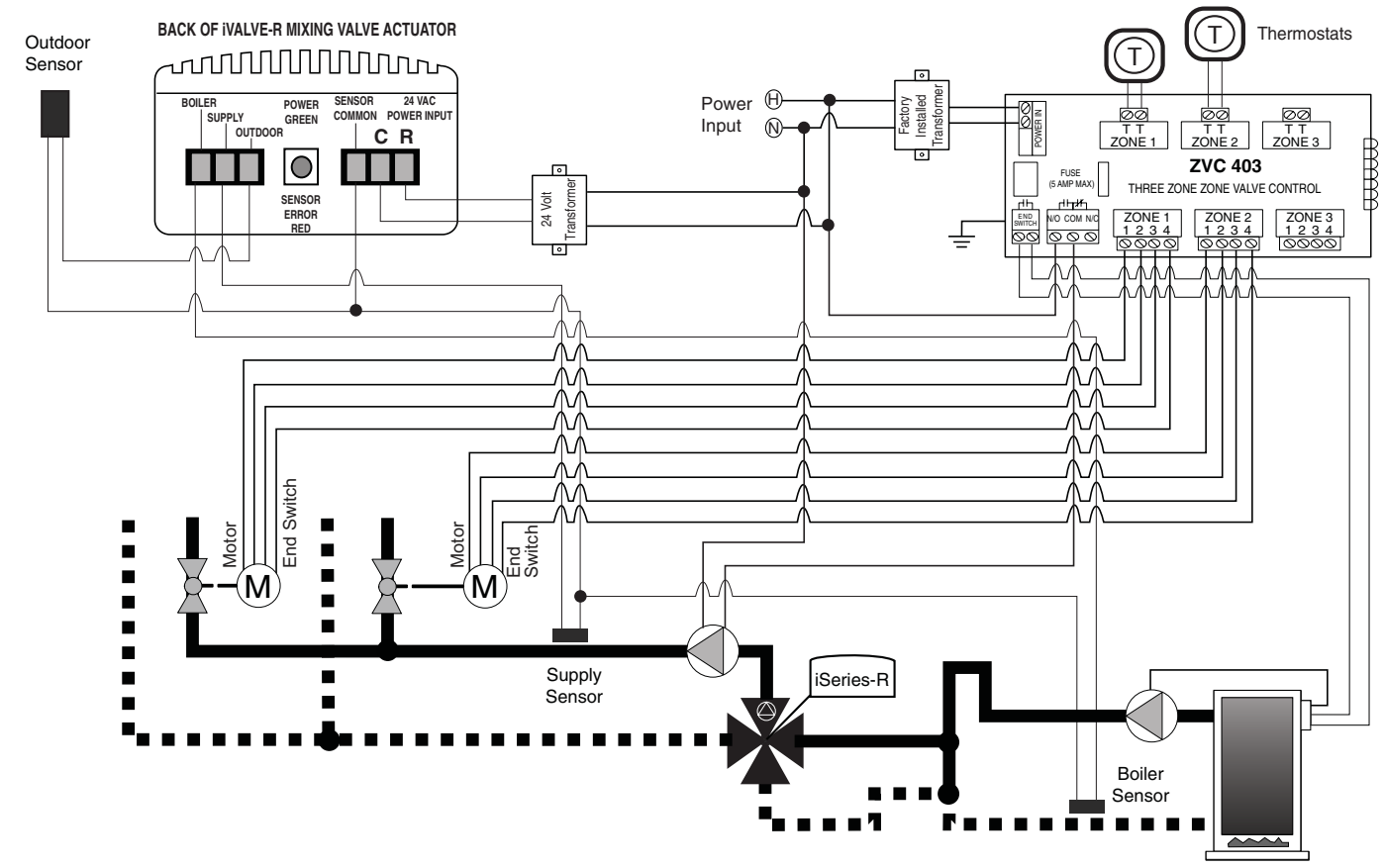
iValve, 3-Way Mixing Working with SR502/503 Switching Relay with DHW Priority



iValve, 4-Way Mixing Working with Zone Valve Control



FOR ADDITIONAL WIRING DIAGRAMS, PLEASE SEE www.taco-hvac.com/wiringwizard

Radiant Mixing Block

The Taco Radiant Mixing Block represents a breakthrough in the design, control and installation of radiant systems. The patent pending design combines a variable speed injection mixing control, injection circulator, system circulator, and air elimination into a single unit. Extremely versatile, the Radiant Mixing Block can be set up as an outdoor reset control, a setpoint control or a delta T limiting control. All this with no special piping, no balancing valve, no closely spaced tees, no external controls, no complex wiring; just four pipe connections and your installation is complete. Welcome to the new age of Radiant!

Manifold Ready

Taco radiant made easy™

Submittal Data Information
Radiant Mixing Block

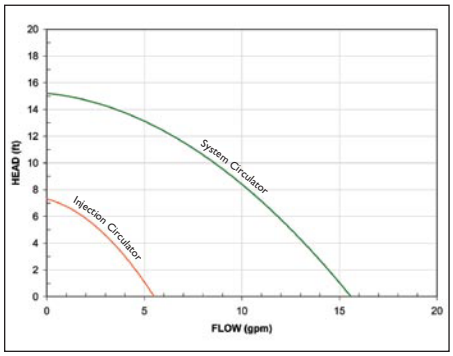
Features

- All-in-One Injection Piping, Pumping, Air Elimination, & Control Package
- Only 4 Pipe Connections Required
- Plug-in Low Voltage Connections
- Solid State Microprocessor Design
- Greatly Decreases Installation Time
- Substantial Space Savings
- Line Cord Included, Hard Wire Option
- Bronze Casing for Open or Closed Systems
- Replaceable Cartridge Design
- Maintenance Free, Wet-Rotor Circulators
- 3 Operation Modes: Outdoor Reset, Setpoint, or Delta T with Limit
- Powered or Unpowered Demand Signal
- Integral Check Valve
- Main System Pump Contact
- 100% Pump Operation / Control Override Switch
- Automatic Pump Exercise
- Adjustable Reset Ratio
- Warm Weather Shutdown
- Boiler Control or Enable Setting
- Boiler Protection
- Large LCD Display
- C° or F°
- Outdoor and 2 Strap-on Sensors included

Performance Data

Flow Range: 0 – ? GPM
Head Range: 0 – ? Feet
Minimum Fluid Temperature: 32°F (0°C)
Maximum Fluid Temperature: 185°F (85°C)
Maximum Working Pressure: 125 psi
Connection Sizes: 3/4" NPT
c UL us LISTED **FOR INDOOR USE ONLY**

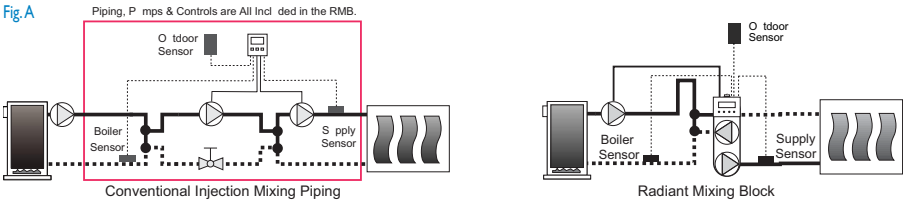
Performance Field



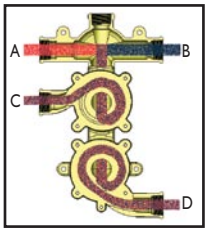
Application

The Taco Radiant Mixing Block (RMB) is a complete injection mixing system. Integral to the unit is a variable speed injection circulator, constant speed system circulator, air elimination, and the electronics to drive it all. With only four piping connections needed, the RMB greatly reduces the time and space required for installation (see Fig. A). The RMB can be set up to operate as an outdoor reset control, a setpoint control or a delta T limiting control, creating flexibility never seen before in a single unit.

Fig. A



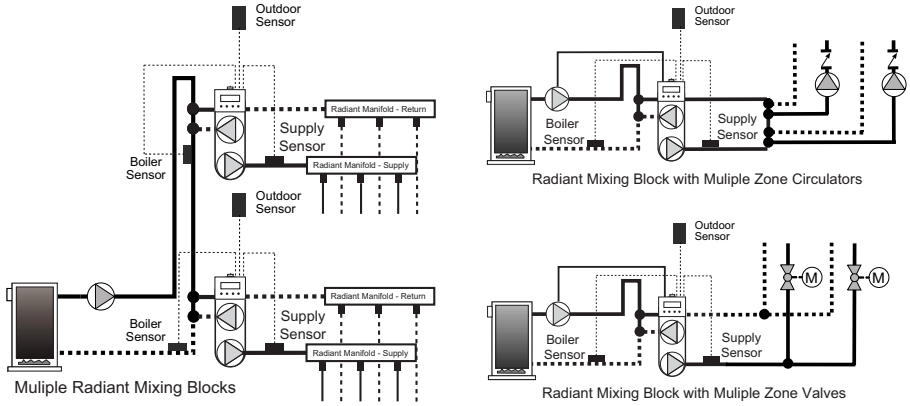
Operation



Hot water from the boiler loop enters the RMB at the Boiler Supply port (A). The cooler return water from the radiant loops enters at the System Return port (B). In the middle of these two ports, any air in the system is purged through the integral Taco Hy-Vent. The injection circulator varies in speed to blend the two temperatures, injecting the excess required temperature back through the Boiler Return port (C). The constant speed system circulator delivers the required blended water temperature to the radiant loop through the Radiant Supply port (D).

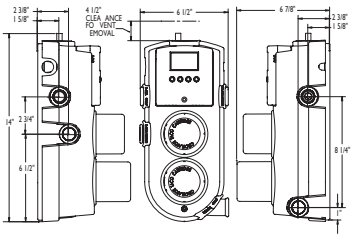
Sizing and Piping

The Radiant Mixing Block can handle radiant load demands of up to 120,000 BTU's. Your current method of zoning the radiant loops (manifolds, zone valves, etc.) does not change with the installation of the RMB. Multiple Radiant Mixing Blocks can be used to separate the distinctive temperature requirements between manifolds. No special piping, just 4 connections and your installation is complete.



Electrical & Weight Data

Model	Volts	Hz	Ph	Amps	RPM	HP	Ship Wt.	
RMB-1	120	60	1	2	3250	1/40 & 1/25	lbs.	Kg
Motor Type	Permanent Split Capacitor Impedance Protected						18.5	8.4

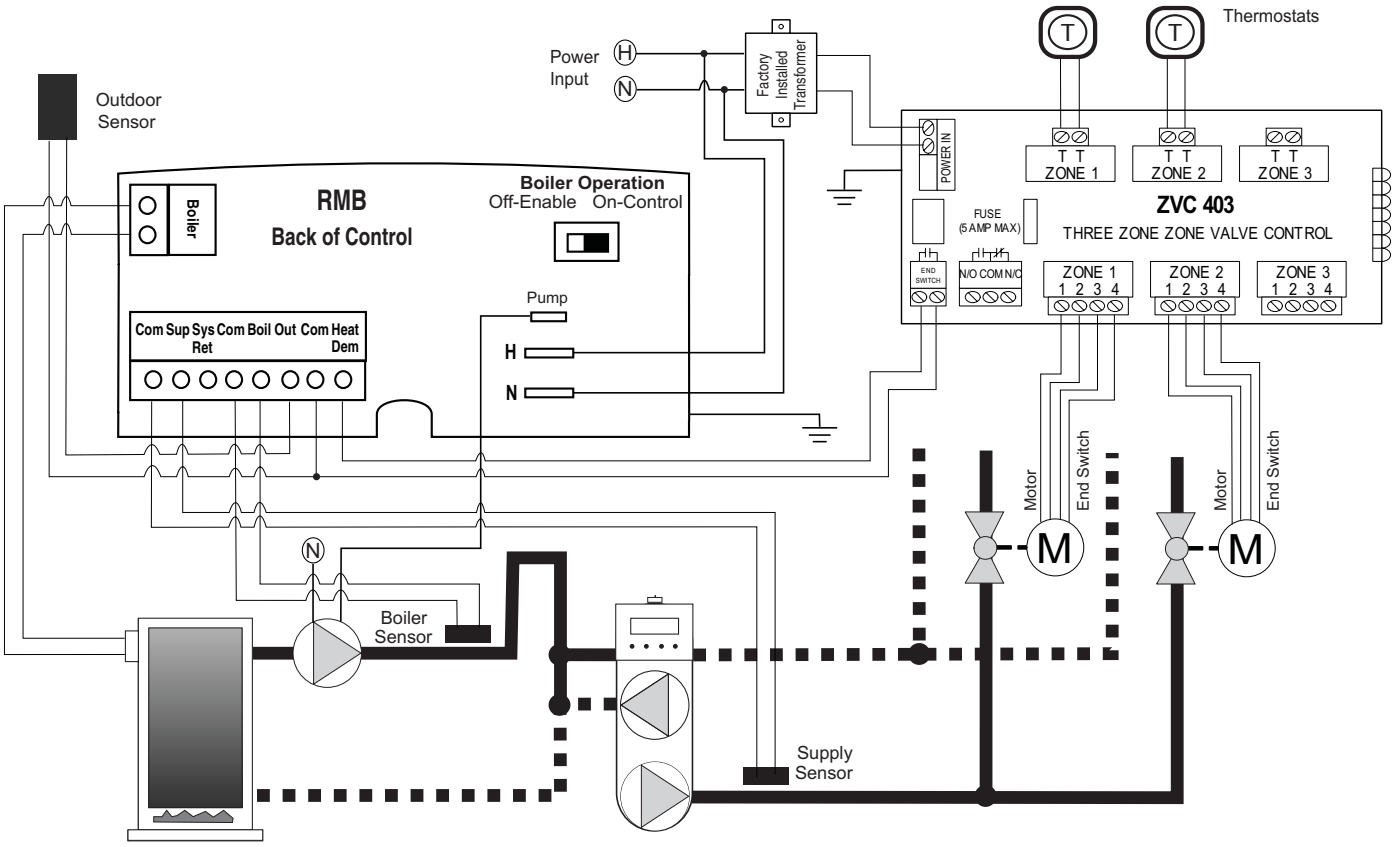


HYDRONIC COMPONENTS & SYSTEMS

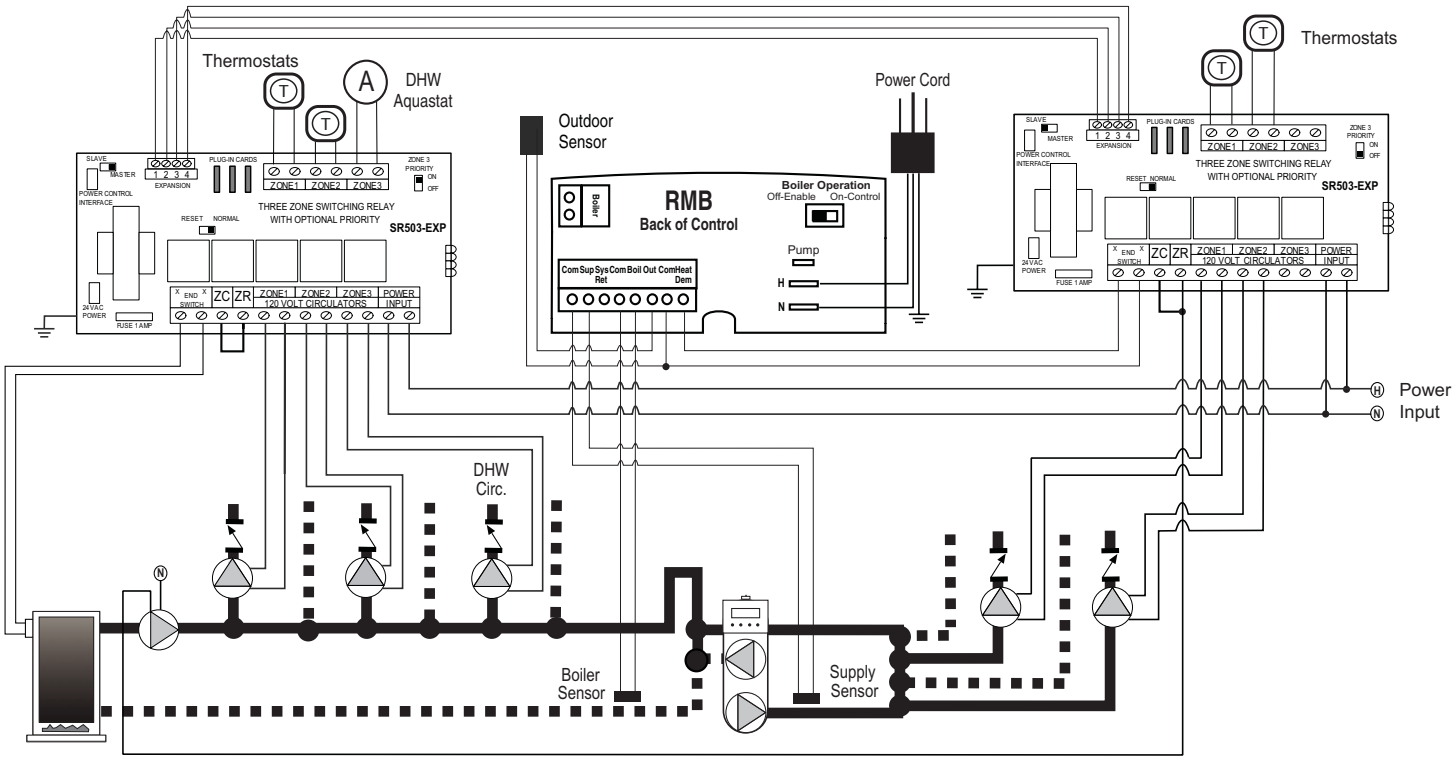
Do it once. Do it right.™ Taco®

Taco Inc., 1160 Cranston Street, Cranston, RI 02920 / (401) 942-8000 / Fax (401) 942-2360
Taco (Canada) Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3 / (905) 564-9422 / Fax (905) 564-9436
www.taco-hvac.com

Radiant Mixing Block Connected to Zone Valve Control with System Pump Wired off the RMB



Radiant Mixing Block Connected to 2 EXP Switching Relays with DHW Pump



FOR ADDITIONAL WIRING DIAGRAMS, PLEASE SEE www.taco-hvac.com/wiringwizard

tekmar® - Data Brochure

3-Way Mixing Valves 710 - 714

D710
05/05

The 3-Way Brass Mixing Valves 710, 711, 712, 713, and 714 are used to mix supply water from a heat source with water returning from a system. They are designed for use in either closed loop or open loop hydronic systems. All valves have standard female NPT threads. The valve provides a maximum leak through rate of 1% to allow for water expansion during temperature changes. The valve position can be manually set using the handle. An Actuating Motor 741 can be used to automatically operate the valve.

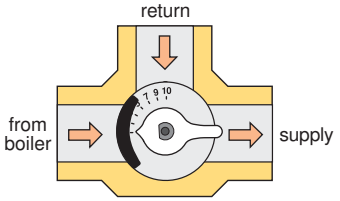
Sequence of Operation

When the flap is in the fully closed position, 100% of the heating system return water is supplied to the system. When the valve flap is in the fully open position, 100% of the boiler supply water enters the heating system. Mixing of the water takes place when the valve flap is in an intermediate position.

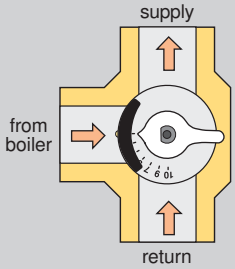
Installation

Check the contents of the package. If any of the items listed below are missing or damaged, please refer to the Limited Warranty and Product Return Procedure on the back of this brochure and contact your wholesaler or local tekmar representative.

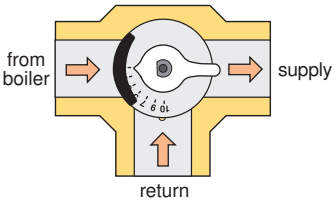
Types 710 - 714 include • One Mixing Valve & One Data Brochure D 710



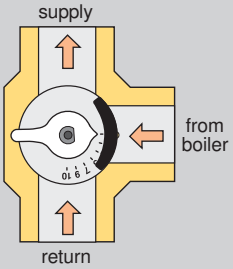
• Factory postion
• No changes required



• Rotate handle 1/4 turn
• Flip face plate over



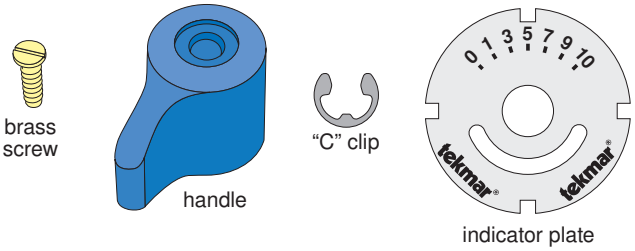
• Rotate handle 1/2 turn
• Flip face plate over



• Rotate handle 1/4 turn

Replacement Parts

The Mixing Valve Handle Kit M3047 contains a replacement manual valve handle, a brass screw, a “C” clip, and a position indicator plate.

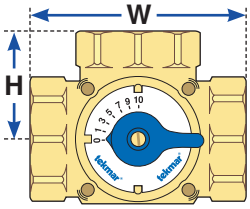


© 2005 tekmar® D 710 - 05/05

Technical Data

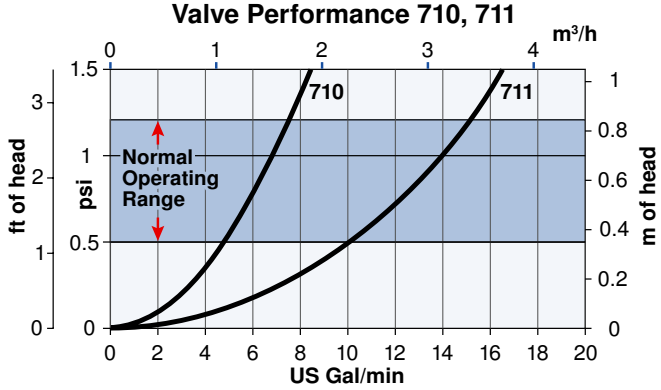
3-Way Mixing Valves 710 - 714 *Brass*

Literature	—	D 710
Maximum Operating Pressure	—	146 psi (10 bar)
Operating Temperature Range	—	-20 to 248°F (-28 to 120°C)
Valve Body and Vane	—	CW 617N - EN 12165 Brass
Shaft Seal	—	Viton “O” ring
Main Seal	—	EPDM Perioxide “O” ring
Acceptable Fluid Media	—	Chilled and hot water with antifreeze and anticorrosive compounds (max 60%), glycol, ethyl alcohol glycol, propylene dichloride alcohol, mono ethyl alcohol, ethyl methyl alcohol, glycerine. *Not for use with media based on mineral oil components or chlorinated pool water.*

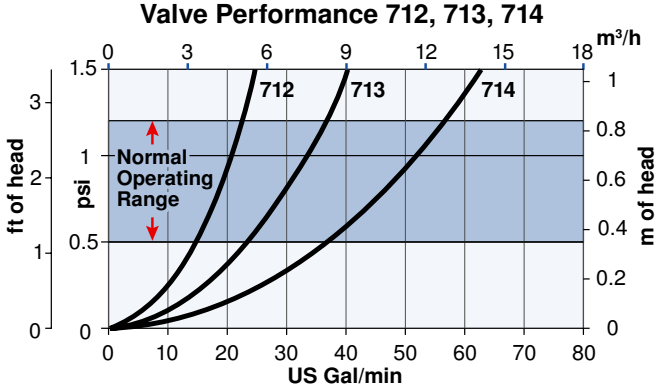


Type	Pipe Size	CV Value	Dimension H	Dimension W	Packaged Weight
710	3/4”	7	1-1/2” (38 mm)	3” (76 mm)	1.9 lbs (860 g)
711	1”	14	1-1/2” (38 mm)	3” (76 mm)	1.6 lbs (730 g)
712	1-1/4”	21	1-5/8” (41 mm)	3-1/4” (82 mm)	1.8 lbs (800 g)
713	1-1/2”	32	2-3/16” (56 mm)	4-3/8” (111 mm)	6.7 lbs (3020 g)
714	2”	51	2-5/16” (60 mm)	4-5/8” (119 mm)	5.6 lbs (2520 g)

Valve Performance 710, 711



Valve Performance 712, 713, 714



Limited Warranty and Product Return Procedure

Limited Warranty ***The liability of tekmar under this warranty is limited. The Purchaser, by taking receipt of any tekmar product (“Product”), acknowledges the terms of the Limited Warranty in effect at the time of such Product sale and acknowledges that it has read and understands same.***

The tekmar Limited Warranty to the Purchaser on the Products sold hereunder is a manufacturer’s pass-through warranty which the Purchaser is authorized to pass through to its customers. Under the Limited Warranty, each tekmar Product is warranted against defects in workmanship and materials if the Product is installed and used in compliance with tekmar’s instructions, ordinary wear and tear excepted. The pass-through warranty period is for a period of twenty-four (24) months from the production date if the Product is not installed during that period, or twelve (12) months from the documented date of installation if installed within twenty-four (24) months from the production date.

The liability of tekmar under the Limited Warranty shall be limited to, at tekmar’s sole discretion: the cost of parts and labor provided by tekmar to repair defects in materials and/or workmanship of the defective product; or to the exchange of the defective product for a warranty replacement product; or to the granting of credit limited to the original cost of the defective product, and such repair, exchange or credit shall be the sole remedy available from tekmar, and, without limiting the foregoing in any way, tekmar is not responsible, in contract, tort or strict product liability, for any other losses, costs, expenses, inconveniences, or damages, whether direct, indirect, special, secondary, incidental or consequential, arising from ownership or use of the product, or from defects in workmanship or materials, including any liability for fundamental breach of contract.

The pass-through Limited Warranty applies only to those defective Products returned to tekmar during the warranty period. This Limited Warranty does not cover the cost of the parts or labor to remove or transport the defective Product, or to reinstall the repaired or replacement Product, all such costs and expenses being subject to Purchaser’s agreement and warranty with its customers.

Any representations or warranties about the Products made by Purchaser to its customers which are different from or in excess of the tekmar Limited Warranty are the Purchaser’s sole responsibility and obligation. Purchaser shall indemnify and hold tekmar harmless from and against any and all claims, liabilities and damages of any kind or nature which arise out of or are related to any such representations or warranties by Purchaser to its customers.

The pass-through Limited Warranty does not apply if the returned Product has been damaged by negligence by persons other than tekmar, accident, fire, Act of God, abuse or misuse; or has been damaged by modifications, alterations or attachments made subsequent to purchase which have not been authorized by tekmar; or if the Product was not installed in compliance with tekmar’s instructions and/or the local codes and ordinances; or if due to defective installation of the Product; or if the Product was not used in compliance with tekmar’s instructions.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH THE GOVERNING LAW ALLOWS PARTIES TO CONTRACTUALLY EXCLUDE, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, DURABILITY OR DESCRIPTION OF THE PRODUCT, ITS NON-INFRINGEMENT OF ANY RELEVANT PATENTS OR TRADEMARKS, AND ITS COMPLIANCE WITH OR NON-VIOLATION OF ANY APPLICABLE ENVIRONMENTAL, HEALTH OR SAFETY LEGISLATION; THE TERM OF ANY OTHER WARRANTY NOT HEREBY CONTRACTUALLY EXCLUDED IS LIMITED SUCH THAT IT SHALL NOT EXTEND BEYOND TWENTY-FOUR (24) MONTHS FROM THE PRODUCTION DATE, TO THE EXTENT THAT SUCH LIMITATION IS ALLOWED BY THE GOVERNING LAW.

Product Warranty Return Procedure All Products that are believed to have defects in workmanship or materials must be returned, together with a written description of the defect, to the tekmar Representative assigned to the territory in which such Product is located. If tekmar receives an inquiry from someone other than a tekmar Representative, including an inquiry from Purchaser (if not a tekmar Representative) or Purchaser’s customers, regarding a potential warranty claim, tekmar’s sole obligation shall be to provide the address and other contact information regarding the appropriate Representative.

tekmar® Control Systems

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Web Site: www.tekmarcontrols.com

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Printed in Canada. D 710 - 05/05.

tekmar® - Data Brochure

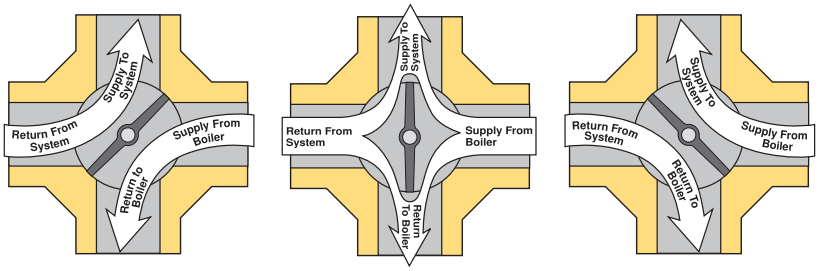
4-Way Mixing Valves 720 - 724

D720
05/05

The 4-Way Brass Mixing Valves 720, 721, 722, 723, and 724 are used to mix supply water from a heat source with water returning from a system. They are designed for use in either closed loop or open loop hydronic systems. All valves have standard female NPT threads. The valve provides a maximum leak through rate of 1% to allow for water expansion during temperature changes. The valve position can be manually set using the handle. An Actuating Motor 741 can be used to automatically operate the valve.

Sequence of Operation

When the flap is in the fully closed position, 100% of the boiler supply water is returned to the boiler and 100% of the heating system return water is supplied to the system. When the valve flap is in the fully open position, 100% of the boiler supply water enters the heating system and 100% of the heating system return water returns to the boiler. Mixing of the water takes place when the valve flap is in an intermediate position.



Valve in closed position | Valve 50% position | Valve fully open

Installation

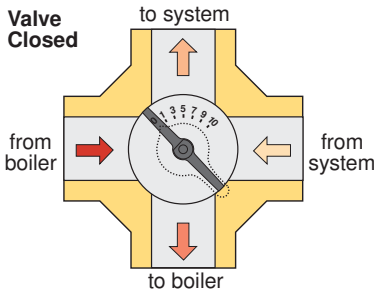
STEP ONE — GETTING READY

Check the contents of the package. If any of the items listed below are missing or damaged, please refer to the Limited Warranty and Product Return Procedure on the back of this brochure and contact your wholesaler or local tekmar representative.

Types 720 - 724 include • One Mixing Valve & One Data Brochure D 720

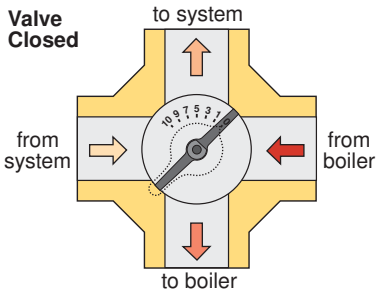
STEP TWO — MOUNTING

Clockwise to Open



As delivered, no changes required.

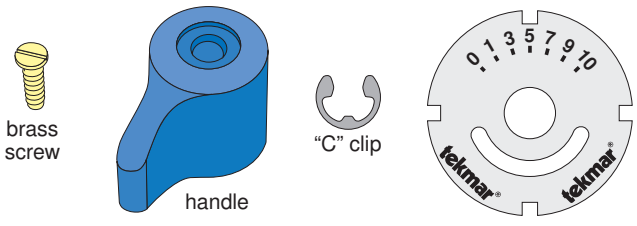
Counter Clockwise to Open



Remove the “C” clip from the shaft. Turn over the indicator plate in order to reverse the scale. Re-install the indicator plate, “C” clip and handle. (components shown below)

Replacement Parts

The Mixing Valve Handle Kit M3047 contains a replacement manual valve handle, a brass screw, a “C” clip, and a position indicator plate.



© 2005 tekmar® D 720 - 05/05

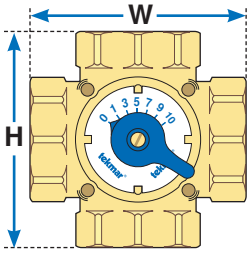
Technical Data

4-Way Mixing Valves 720 - 724 *Brass*

Literature — D 720
Maximum Operating Pressure — 146 psi (10 bar)
Operating Temperature Range — -20 to 248°F (-28 to 120°C)
Valve Body and Vane — CW 617N - EN 12165 Brass
Shaft Seal — Viton “O” ring
Main Seal — EPDM Perioxide “O” ring

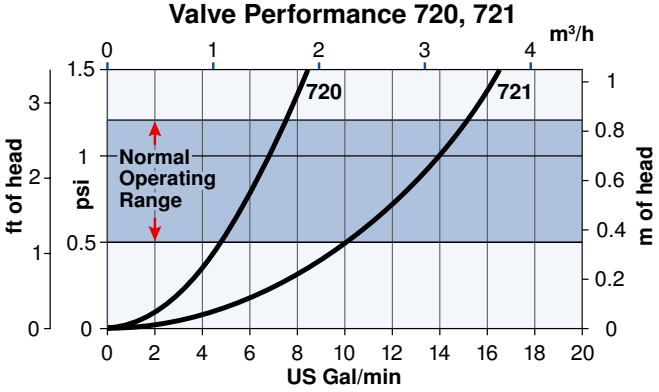
Acceptable Fluid Media — Chilled and hot water with antifreeze and anticorrosive compounds (max 60%), glycol, ethyl alcohol glycol, propylene dichloride alcohol, mono ethyl alcohol, ethyl methyl alcohol, glycerine.

Not for use with media based on mineral oil components or chlorinated pool water.

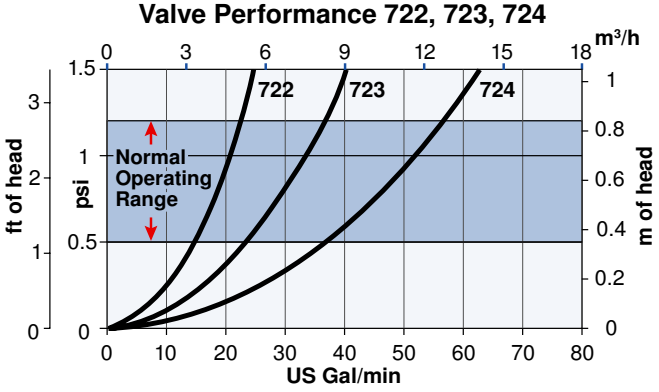


Type	Pipe Size	CV Value	Dimension H	Dimension W	Packaged Weight
720	3/4”	7	3” (76 mm)	3” (76 mm)	2.2 lbs (980 g)
721	1”	14	3” (76 mm)	3” (76 mm)	1.8 lbs (800 g)
722	1-1/4”	21	3-1/4” (82 mm)	3-1/4” (82 mm)	2.2 lbs (980 g)
723	1-1/2”	32	4-3/8” (111 mm)	4-3/8” (111 mm)	7.3 lbs (3320 g)
724	2”	51	4-5/8” (119 mm)	4-5/8” (119 mm)	5.8 lbs (2640 g)

Valve Performance 720, 721



Valve Performance 722, 723, 724



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The pass-through Limited Warranty applies only to those defective Products returned to tekmar during the warranty period. This Limited Warranty does not cover the cost of the parts or labor to remove or transport the defective Product, or to reinstall the repaired or replacement Product, all such costs and expenses being subject to Purchaser’s agreement and warranty with its customers.

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tekmar® Control Systems

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Web Site: www.tekmarcontrols.com

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TURBOMAX® INDIRECT WATER HEATERS

TURBOMAX® 109

Domestic hot water produced per hour in U.S. gallons†

Net BTUH	kW	First hour 110°F	140°F	180°F	Continuous 110°F	140°F	180°F
400 000	117	807	531	363	687	483	346
500 000	146	979	651	450	859	603	436
600 000	176	1151	772	536	1031	724	516
700 000	205	1323	893		1202	845	
800 000	234	1494	1013		1374	965	
900 000	264	1666			1546		

TURBOMAX® 45

Domestic hot water produced per hour in U.S. gallons†

Net BTUH	kW	First hour 110°F	140°F	180°F	Continuous 110°F	140°F	180°F
200 000	59	392	261	180	344	241	173
250 000	73	477	321	223	429	302	216
300 000	88	563	381	266	515	362	260
350 000	103	649	442		601	422	
400 000	117	735	502		687	483	
450 000	132	821	562		773	543	
500 000	146	907			859		

TURBOMAX® 34

Domestic hot water produced per hour in U.S. gallons†

Net BTUH	kW	First hour 110°F	140°F	180°F	Continuous 110°F	140°F	180°F
50 000	15	126	76	49	88	60	43
100 000	29	211	137	92	172	121	87
150 000	44	297	197	135	258	181	130
200 000	59	383	257	179	344	241	173
250 000	73	469	318	222	429	302	216
300 000	88	555	378		515	362	
350 000	103	641	438		601	422	
400 000	117	727			687		

TURBOMAX® 24

Domestic hot water produced per hour in U.S. gallons†

Net BTUH	kW	First hour 110°F	140°F	180°F	Continuous 110°F	140°F	180°F
50 000	15	112	71	47	88	60	43
100 000	29	198	131	90	172	121	87
150 000	44	284	192	134	258	181	130
200 000	59	370	252	177	344	241	173
250 000	73	455	312	220	429	302	216
300 000	88	542	373		515	362	
350 000	103	628	433		601	422	
400 000	117	714			687		

† Based on ASHRAE (D.O.E.) test method performed by CRIQ. Domestic cold water at 40°F and boiler water at 180°F.

Technical Information

Standby loss <1/2°F per hour
Heat Transfer Efficiency = 99%
Output Temperature up to 200°F
Tube Max. Allowed ASME = 150 PSI at 250°F Working Pressure
Shell Max. Allowed ASME = 150 PSI at 250°F Working Pressure

U stamp on Turbomax ASME Models only

TURBOMAX® 65

Domestic hot water produced per hour in U.S. gallons†

Net BTUH	kW	First hour 110°F	140°F	180°F	Continuous 110°F	140°F	180°F
200 000	59	416	270	183	344	241	173
250 000	73	501	331	227	429	302	216
300 000	88	587	391	270	515	362	260
350 000	103	673	451		601	422	
400 000	117	759	512		687	483	
450 000	132	845	572		773	543	
500 000	146	931			859		

TURBOMAX® 44

Domestic hot water produced per hour in U.S. gallons†

Net BTUH	kW	First hour 110°F	140°F	180°F	Continuous 110°F	140°F	180°F
50 000	15	134	80	50	86	60	43
100 000	29	220	140	93	172	121	87
150 000	44	306	200	137	258	181	130
200 000	59	392	261	180	344	241	173
250 000	73	477	321	223	429	302	216
300 000	88	563	381		515	362	
350 000	103	649	442		601	422	
400 000	117	735			687		

TURBOMAX® 33

Domestic hot water produced per hour in U.S. gallons†

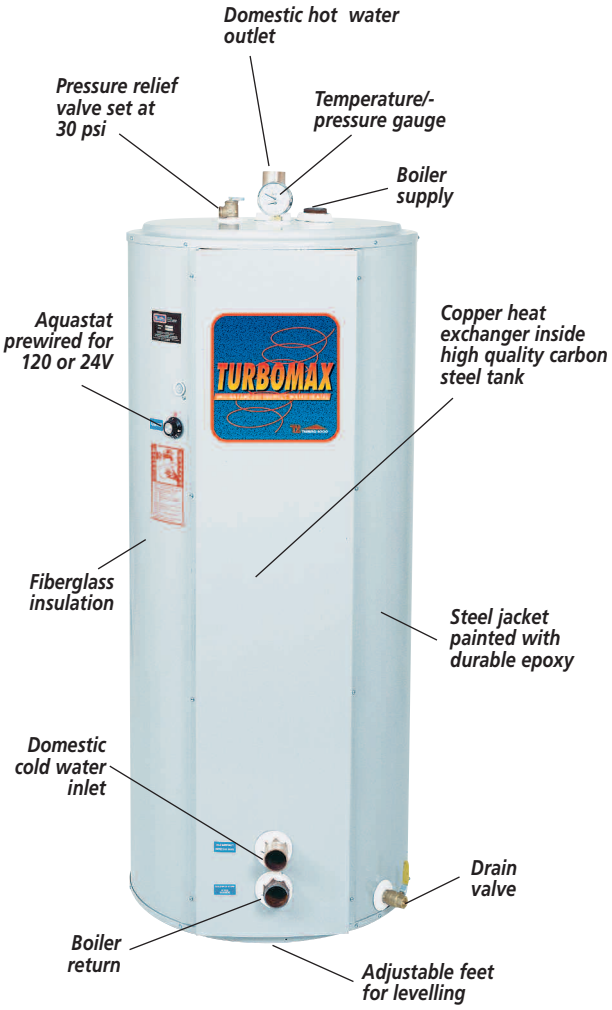
Net BTUH	kW	First hour 110°F	140°F	180°F	Continuous 110°F	140°F	180°F
50 000	15	126	76	49	86	60	43
100 000	29	211	137	92	172	121	87
150 000	44	297	197	135	258	181	130
200 000	59	383	257	179	344	241	
250 000	73	469	318	222	429	302	
300 000	88	555	378		515		

TURBOMAX® 23

Domestic hot water produced per hour in U.S. gallons†

Net BTUH	kW	First hour 110°F	140°F	180°F	Continuous 110°F	140°F	180°F
50 000	15	112	71	47	86	60	43
100 000	29	198	131	90	172	121	87
150 000	44	284	192	134	258	181	130
200 000	59	370	252		344	241	
250 000	73	456	312		429	302	
300 000	88	542			515		

Standard Equipment



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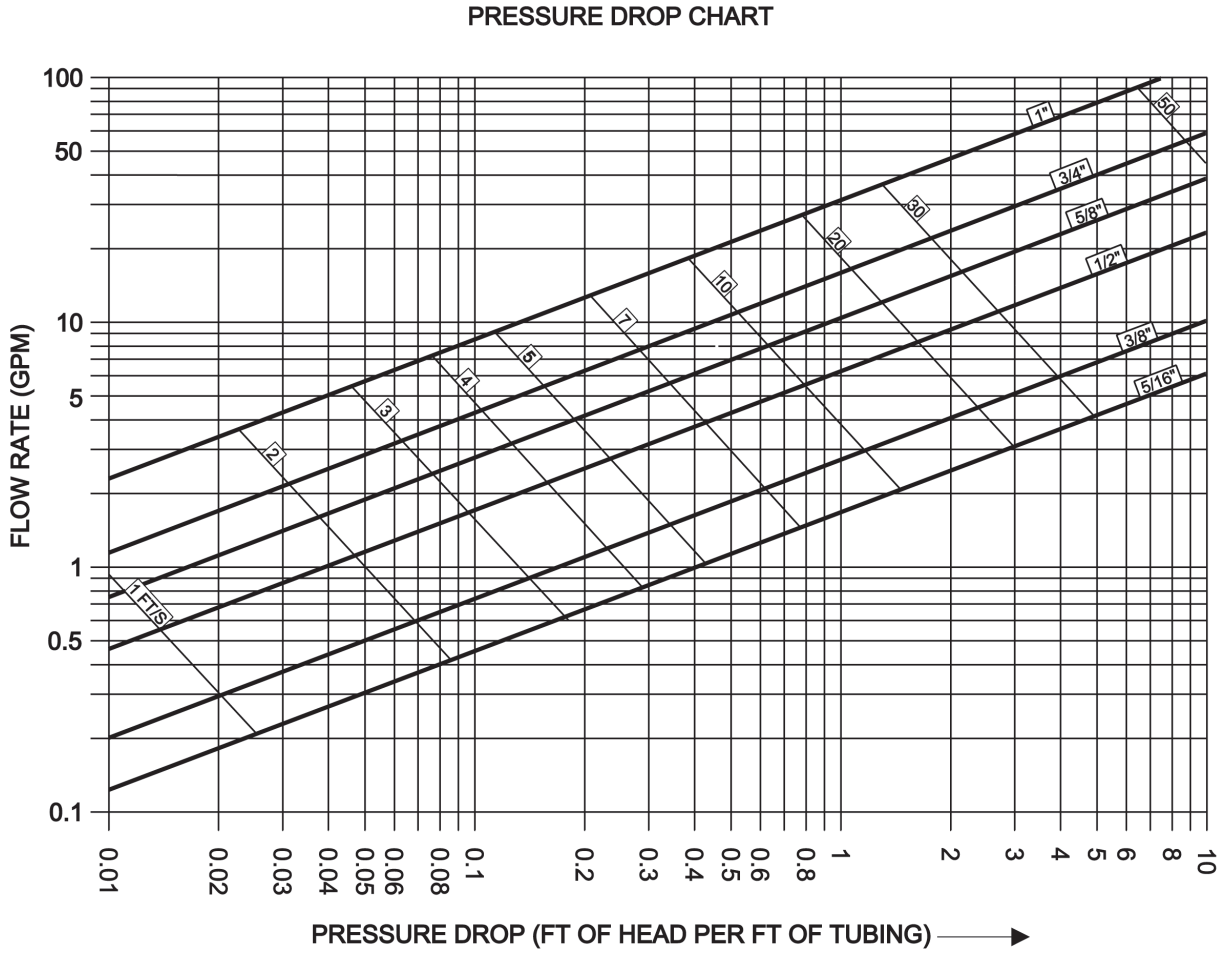
Specifications

Model	Tank volume	Heat transfer area (sq.ft.)	Utility connection	Boiler connection	Hgt.	Diam.	Shipping weight
TURBOMAX 109	119 US gal.	58.9 ft^2	2" Sweat M	2" NPTM	74"	29"	555 lbs
TURBOMAX 65	72 US gal.	32.7 ft^2	1 1/2" Sweat M	1 1/2" NPTM	67"	24"	250 lbs
TURBOMAX 45	48 US gal.	32.7 ft^2	1 1/2" Sweat M	1 1/4" NPTM	55"	22"	235 lbs
TURBOMAX 44	48 US gal.	26.2 ft^2	1 1/2" Sweat M	1 1/4" NPTM	55"	22"	210 lbs
TURBOMAX 34	36 US gal.	26.2 ft^2	1 1/2" Sweat M	1 1/4" NPTM	65"	18"	195 lbs
TURBOMAX 33	36 US gal.	19.6 ft^2	1 1/4" Sweat M	1 1/4" NPTM	65"	18"	170 lbs
TURBOMAX 24	26 US gal.	26.2 ft^2	1 1/2" Sweat M	1 1/4" NPTM	49"	18"	175 lbs
TURBOMAX 23	26 US gal.	19.6 ft^2	1 1/4" Sweat M	1 1/4' NPTM	49"	18"	150 lbs

ASME Models Specifications

Model	Tank volume	Heat transfer area (sq.ft.)	Utility connection	Boiler connection	Hgt.	Diam.	Shipping weight
TURBOMAX 109A	110 US gal.	58.9 ft^2	2 1/2" Sweat M	2" NPTM	74"	29"	755 lbs
TURBOMAX 65A	70 US gal.	32.7 ft^2	2" Sweat M	1 1/2" NPTM	67"	24"	340 lbs

Pressure Drop Chart
Pextron Tubing Data



Pextron Tubing Data Table			
Nominal Size (in.)	**Outside Diameter (in.)**	**Inside Diameter (in.)**	**Water Content (Gal/ft.)**
5/16	0.430	0.292	0.004
3/8	0.500	0.350	0.005
1/2	0.625	0.475	0.009
5/8	0.750	0.574	0.014
3/4	0.875	0.671	0.018
1	1.125	0.862	0.030

Pextron Tubing Specifications

Tubing Dimensions and Tolerances:
I.D., O.D., and wall thickness according to ASTM Standard F876

Continuous Pipe Dimension Production Testing:
By laser sensors and ultra sound

Standard Thermoplastic Pipe Dimension Ratio:
ASTM F876 - SDR 9

Maximum Operating Temperature and Pressure for Tubing:
200°F at 80 psi
180°F at 100 psi
73.4°F at 160 psi

Base Material:
High density polyethylene

Cross-linking Method:
Electronically cross-linked by means of high energy electron beam

Molecular Leak Detection Test Procedure:
Computerized high vacuum-helium testing

Oxygen Diffusion Standard:
DIN 4726

Listing:
cNSF®us-rfh
ANSI/NSF 14

Chemical Tubing Resistance Chart:
DIN 8075 Standard

UV Resistance:
90 days maximum exposure

Limited Warranty:
25 years covering manufacturer related tubing defects

Technical Specifications:

Degree of Cross-linking	65-70%	ASTM F876 F877, DIN 16892
Long term internal pressure creep strength resistance safety factor after 50 years of service life, taking into account the temperature aging behavior of the piping material	At water temp. of 140°F At water temp. of 200°F	Safety factor: 7.50 Safety factor: 4.75 DIN 16892
Density	58.68 lbs/ft^3	DIN 53479
Tensile Strength	3338 psi	DIN 53455
Percentage of Elongation	400%	DIN 53455
Modulus of Elasticity	87082 psi	DIN 53457
Impact Strength at –40°F	no fracture	DIN 53453
Notch Sensitivity at –4°F	no fracture	DIN 53453
Environmental Stress Cracking Resistance	no cracking	ASTM D 1693
Thermal Conductivity	2.43 Btu*in/h/ft^2/°F	DIN 52612
Thermal Coefficient of Linear Expansion	0.000078 in/in/°F	DIN 52328
Oxygen Diffusion Rate with O_2 Barrier at 104°F	0.0036 mg/l/24h	DIN 4726
Oxygen Diffusion Rate with O_2 Barrier at 203°F	0.0757 mg/l/24h	DIN 4726

Pex Tubing Data Table

Nominal Size (in.)	Outside Diameter (in.)	Inside Diameter (in.)	Water Content (Gal/ft.)
5/16	0.430	0.292	0.004
3/8	0.500	0.350	0.005
1/2	0.625	0.475	0.009
5/8	0.750	0.574	0.014
3/4	0.875	0.671	0.018
1	1.125	0.862	0.030
1-1/4"	1.375	1.055	0.045
1-1/2"	1.625	1.245	0.063

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SP-11108-06/06

ProRadiant™ SYSTEMS

viega

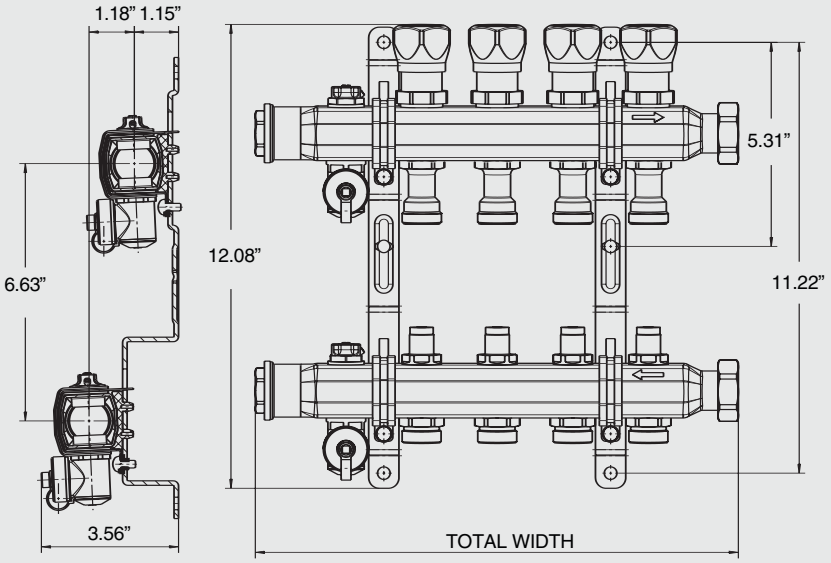
Product Instructions

Stainless Manifold Shut Off/Balancing

PRODUCT DESCRIPTION

These preassembled 1-1/4” diameter stainless supply and return manifolds come attached to two 6-5/8” spacing brackets for compact remote mounting. This stainless manifold provides shut off and balancing valves for each circuit. Manifolds used with flow rates up to 2 gpm per circuit, maximum of 18 gpm per manifold. The air bleeder and purge valve are connected and factory tested. 1-1/4” Union connection, 1” NPT removable end caps. SVC Circuit connection fittings are sold separately.

Dimensions	
Height	12.1”
Depth	3.6”
Manifold	**Total Width**
2 outlets	10.2”
3 outlets	10.2”
4 outlets	12.2”
5 outlets	14.1”
6 outlets	16.1”
7 outlets	18.1”
8 outlets	20.0”
9 outlets	22.0”
10 outlets	24.0”
11 outlets	25.9”
12 outlets	27.9”

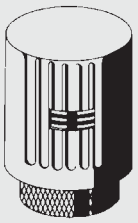


Technical Data

1. 1-1/4” 304 Stainless Header Stock
2. Supply Manifold with Balancing valve/flow meter
3. Return Manifold with shut off valves (blue caps)
4. Factory installed air bleeders and purge valves
5. Mounting Brackets
6. Max. operating temperature: 180°F
   Short periods of 200°F
7. Max. operating pressure: 100 psi

The return header is fitted with shut off valves which are suitable to receive optional 24V powerheads for control over each circuit via thermostat.

Note: Use new style white cap powerheads with this mainfold (stock code 15 061).



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PI-PR Manifold SO/B
518857-01/07

Diverting Valve
Product Instructions

Applications

Viega NA three way diverting valves can be used for temperature control in many heating and snowmelting applications.

Features

- Includes solder tailpieces (1-1/4" and 1-1/2" models use same valve body with different tailpieces)
- Pre-installed high limit kit
- Compatible with most Viega NA actuators (Three Position 18 003, Two Position 18 005, and non-electric models 16 101 thru 16 105)

Specifications

Materials:
Bronze valve body
Brass and corrosion-resistant steel internal components
EPDM rubber seals

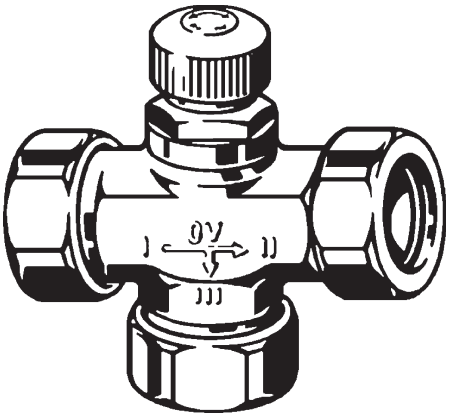
Actuator threads: M30 x 1.0

Max working temp.: 242°F (120°C)
Max working pressure: 145 psi (10 bar)
Max differential pressure (tight shut-off on both end positions of valve discs)

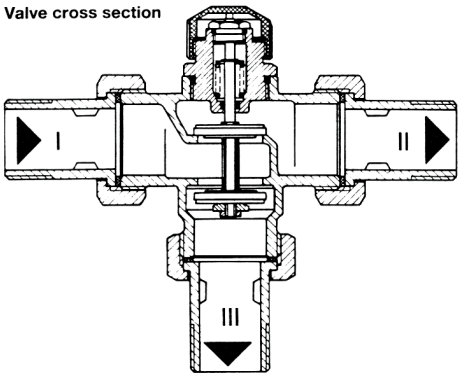
3/4"	10.9 psi	(75 kPa)
1"	7.3 psi	(50 kPa)
1-1/4"	2.9 psi	(20 kPa)
1-1/2"	2.9 psi	(20 kPa)

Operation

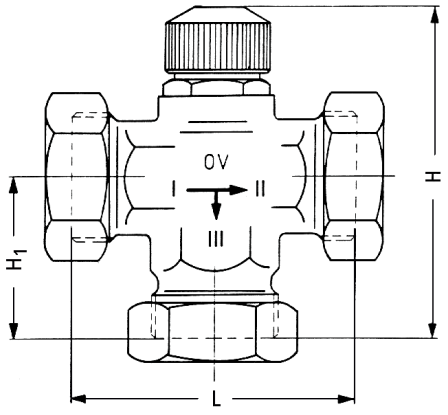
Viega NA diverting valves have one entry port and two exit ports (see diagram below). Depending upon the position of the valve stem, flow is diverted from one exit port to the other.



Valve cross section

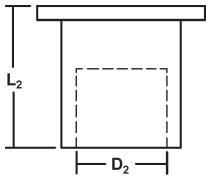


Dimensions



Size	Stock Code	L (inches)	H (inches)	H_1 (inches)
3/4"	20 001	3.15	3.94	1.85
1"	20 002	3.54	4.06	1.97
1-1/4"	20 003	4.53	4.65	2.52
1-1/2"	20 041	4.53	4.65	2.52

Solder tailpieces



Size	D_2 (inches)	L_2 (inches)
3/4"	0.875	0.91
1"	1.125	1.18
1-1/4"	1.375	1.57
1-1/2"	1.625	1.26

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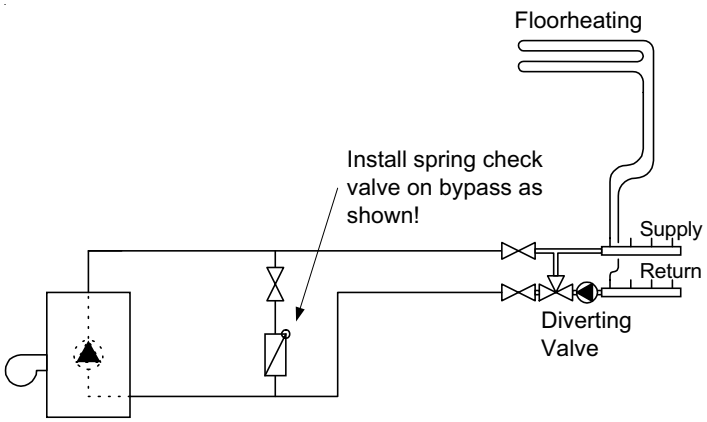
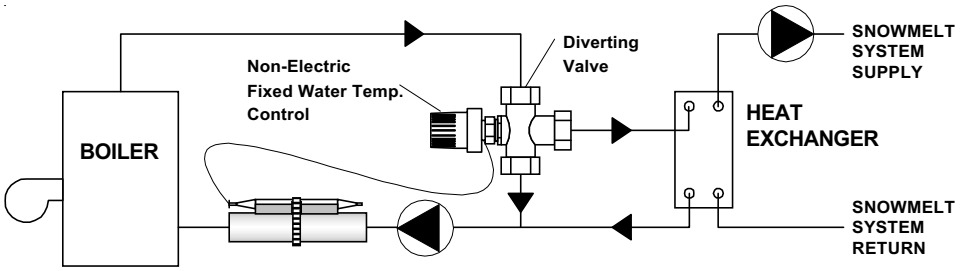
PI-20001-02/04

Diverting Valve
Product Instructions

Piping a Diverting Valve with a Circulator Installed in Boiler



Diverting valves may also be used to control small snow melting systems as shown at right. For further details, refer to instructions with Viega NA Snow Melt controls.

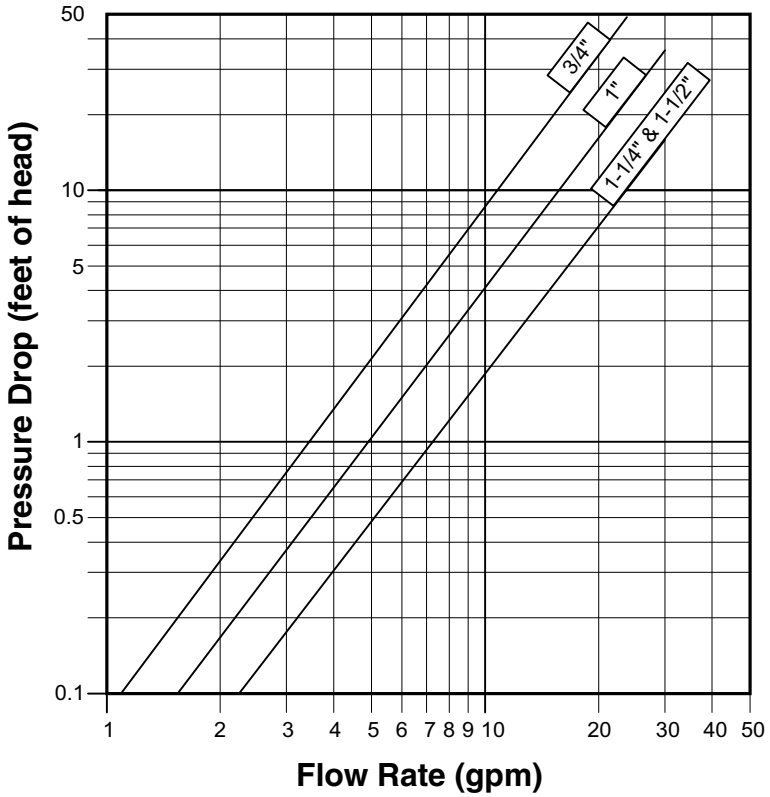


Pressure Drop

Pressure drop values for Viega NA diverting valves may be determined from the chart at right (c_v values are listed below).

1-1/4” and 1-1/2” models share the same valve body, so the pressure drop for these models is the same.

Valve size	c_v
3/4”	5.3
1”	7.6
1-1/4”	11.1
1-1/2”	11.1



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PI-20001-02/04

4.2 Sizing the 3-Way Mixing Valve

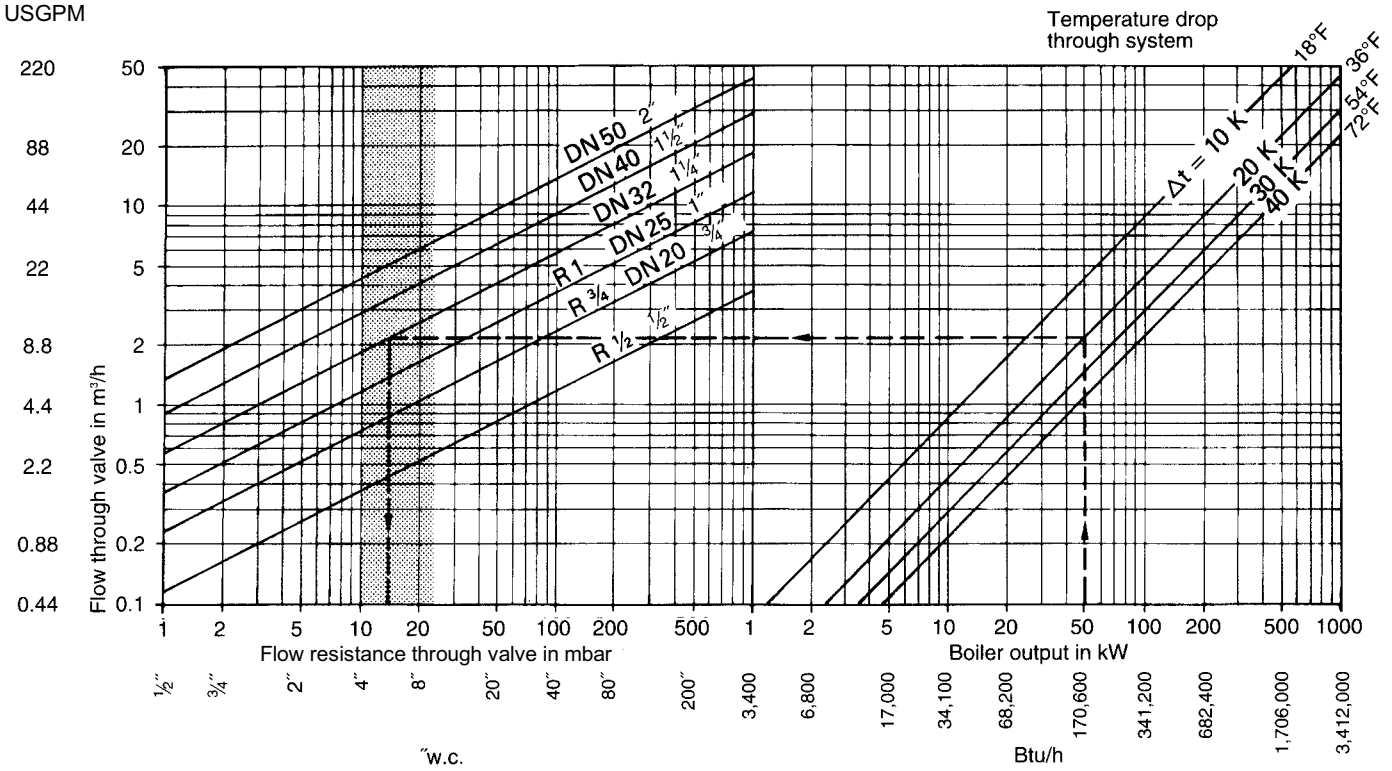

Fig. 19
Sizing chart for 3-way mixing valve

The selection of the size of the mixing valve can be done using the above diagram. The best mixing ratio and velocity conditions with the 3-way mixing valve are achieved when the selected mixing valve is within the shaded section.

Selecting the mixing valve in the following way will ensure the best mixing effect for the system supply and the system return:

1. In the right-hand side of the diagram, select the amount of Btu/h / kW available for the heating system or the heating loop.
2. Draw a straight line up through the temperature drop available through the system (diagonal lines).
3. Select the temperature differential where the vertical line crosses the diagonal line. Follow a line to the left into the shaded area (the shaded area is between 4” and 8” w.c. / 10 and 25 mbar). The line crossed indicates the proper size mixing valve.
4. Extend a vertical line downwards and read the exact pressure drop through the valve; add this pressure drop to the pump head.
5. By extending the horizontal line to the left of the diagram, the USGPM / m^3/h of water flow can be read.

Example

The dashed line in the above diagram shows a boiler with 170,600 Btu/h / 50 kW output. The heating system has a temperature differential between boiler supply and return of 36°F / 20°C and the selected mixing valve is 1¼”. The required pumping rate is 9 USGPM / 2.1 m^3/h.

5167 158

3.2 Sizing the 4-Way Mixing Valve

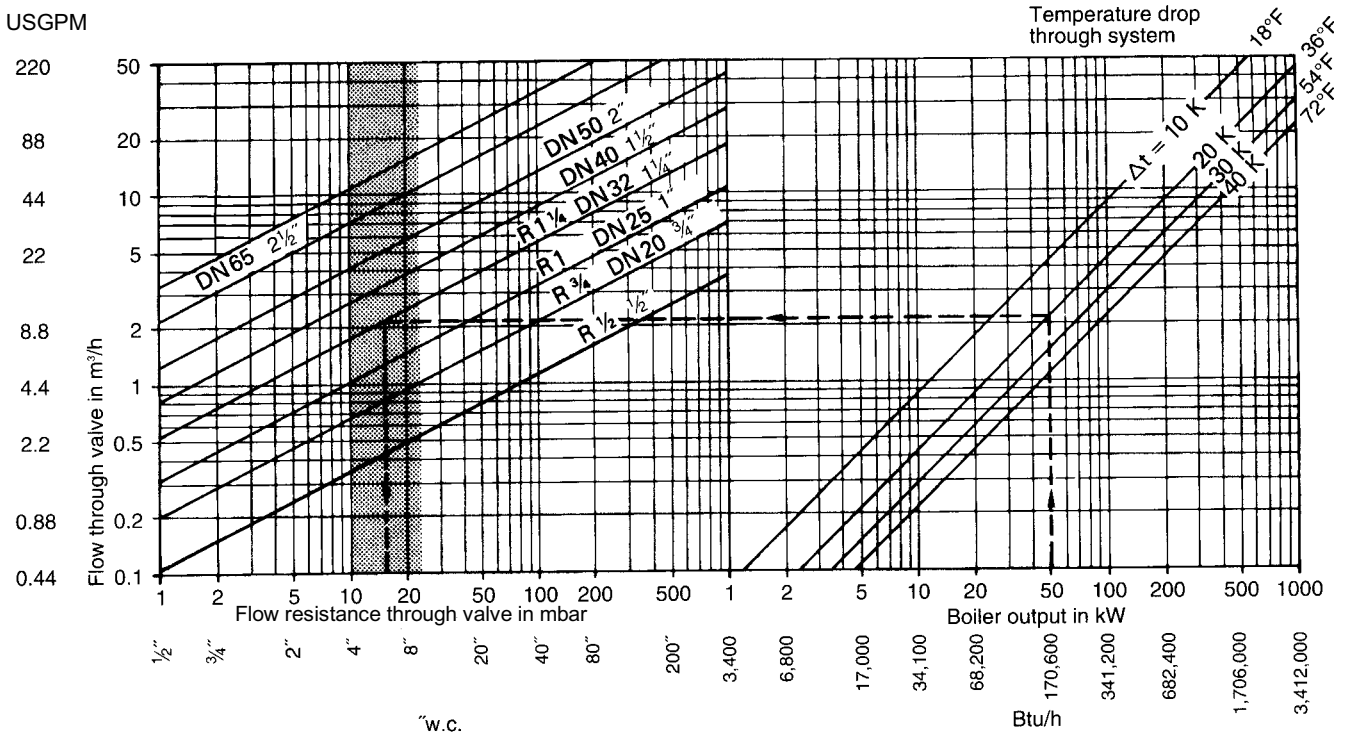

Fig. 5
Sizing chart for 4-way mixing valve

The selection of the size of the mixing valve can be done using the above diagram. The best mixing ratio and velocity conditions with the 4-way mixing valve are achieved when the selected mixing valve is within the shaded section.

Selecting the mixing valve in the following way will ensure the best mixing effect for the system supply and the system return:

1. In the right-hand side of the diagram, select the amount of Btu/h / kW available for the heating system or the heating loop.
2. Draw a straight line up through the temperature drop available through the system (diagonal lines).
3. Select the temperature differential where the vertical line crosses the diagonal line. Follow a line to the left into the shaded area (the shaded area is between 4" and 8" w.c. / 10 and 25 mbar). The line crossed indicates the proper size mixing valve.
4. Extend a vertical line downwards and read the exact pressure drop through the valve; add this pressure drop to the pump head.
5. By extending the horizontal line to the left of the diagram, the USGPM / m^3/h of water flow can be read.

Example

The dashed line in the above diagram shows a boiler with 170,600 Btu/h / 50 kW output. The heating system has a temperature differential between boiler supply and return of 36°F / 20°C and the selected mixing valve is 1¼". The required pumping rate is 9 USGPM / 2.1 m^3/h.

5167 158

BUDERUS
AM-10 QUICK REFERENCE SHEET

Wiring: There are three sets of terminals along the bottom of the control. THE BOTTOM OF THE CONTROL WILL END UP UPSIDE DOWN WHEN LOOKING at it from the front looking into the boiler. It mounts only this way.

Pair 1:

The pair all the way to the left accepts the little white plug that is lying in the rear of the boilers wiring harnesses to plug into. This is how it gets powered up and how it communicates to the GB-142's circuit board.

Pair 2:

The middle pair: accept a thermostat connection from a regular thermostat or an end switch in a pump relay box or a zone control relay box.

Pair 3:

The right hand pair: accept the outdoor sensor wire. This is typically a pair of 18-2 thermostat wires running outside the building to a sensor mounted on the north side of the building.

Mode button: when depressed, moves the cursor from icon to icon

Icons and their meanings: From left to right are the… **House**, **Radiator**, **Target adjustment**, **Basepoint** adjustment, and the **Sun/Snowflake**

The **House** icon is ***non-adjustable***: Tells you the current outdoor temperature according to the outdoor sensor. This is true when the cursor is located above the icon in the LED display. The **Mode** button is what moves the cursor to the icon position.

The **Radiator** icon is ***non-adjustable*** and is referred to in the instruction manual as the **FLOW TEMPERATURE SETPOINT** and is the temperature that the boiler will target based on the **outdoor** temperature and the **Setpoint** adjustment temperature and the **Basepoint** settings.

The **Target adjustment** is ***adjustable*** and is the temperature you want the boiler supply temperature to be when the outdoor temperature is at 14 degrees Fahrenheit. For Baseboard, the typical temperature setpoint is 165 degrees Fahrenheit. Of course, the BC-10 or "Boiler Control" itself must be set for at least 180 degrees as the boiler sees what is set on the dial of the BC-10 as its high limit. The logic is that the burner will ride off of that point and modulate whenever the "**Radiator**" target nears that temperature.

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10 INDUSTRIAL PARKWAY
WOBURN MA 01801

Michael Fox
02/21/2007
THIS IS ONLY A CONCEPT DRAWING. ALL CONDITIONS AND NECESSARY COMPONENTS MUST BE FIELD VERIFIED AND ARE THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR

BUDERUS
AM10 QUICK SET UP (CONT"D)

The **Basepoint** adjustment is ***adjustable*** and is simply the *minimum supply temperature* that you want the boiler to shoot for whenever the boiler has a *call for heat* and is *below Warm Weather Shut Down.*

Example of a need for a **Basepoint**: **Baseboard heating elements** work on convection and will not move air over their elements at a very fast pace if the difference in temperature between the element and the room is not large enough. What is large enough? Typically, if you have at least 100-110 degrees F, you CAN get heat out of baseboard.

Another example might be for an air handler with a **Hydronic Coil** which will feel like it has cold air blowing from it when the supply water temperature going to it is below 115 degrees Fahrenheit.

Sun/Snowflake: is simply your outdoor temperature shut down or Warm Weather Shut Down, otherwise referred to as your WWSD and will keep the boiler from turning on if the outdoor temperature is above this setting and there is a *call for heat* at the thermostat contacts on the center pair of the terminals on the AM-10 control module. ***This temperature is typically set at 68 degrees Fahrenheit.***

Remember, **Outdoor + Target adjustment + Basepoint = Radiator** target temperature

Wrench icon: when seen in the LED display simply means that the boiler is locked out in fault mode.

Depending on the code you see (you must look up the code in the Boiler installation Instruction Booklet under Troubleshooting), the boiler may or may not run. For instance, if the control doesn't see an outdoor sensor, it will have three flat lines across the LED display like this - - - and will only let the boiler run until the supply temperature is 122 degrees F.

The "**Heat Call**" Icon is what will appear in the LED display whenever there is a call for heat.

The "**Flame"** Icon is what you will see when the burner is running. It is **black** in color.

For more information, refer to the manual. For issues beyond that call Buderus Technical Support at 603-552-1100 or Capco Energy Supply Inc. @ 781-721-0303.

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The Lochinvar Knight Boiler

Quick Set Up Sheet

Quick Set Up Instructions for entering settings for "INSTALLERS ONLY".

MENU / EXIT

Press Once to Enter "programming"...boiler will shut off

SHUTDOWN

ENTER / RESET

Press and HOLD for 5 seconds...***Last digit*** will begin ***flashing***. *note, the ***Installer code is 5309***
The homeowner code is 0704

UP

Push ***nine*** times Until last digit reads 9

PREVIOUS

Then, Press and release the "Previous Button" ***two*** times to bypass the third digit and get to the second digit since the third digit already has a "0" (ZERO)

UP

Then Press and release the "UP" Button ***three*** times To achieve the number 3 in the second digit

PREVIOUS

Then, Press and release the "Previous Button" ***one*** time to get to the first digit so you can enter the "5"

UP

Then Press and release the "UP" Button ***five*** times To achieve the number 5 in the first digit

IF YOU ENTER A DIGIT INCORRECTLY, SIMPLY USE THE NEXT OR PREVIOUS BUTTONS TO MANEUVER BACK TO THAT DIGIT UNTIL IT FLASHES AND THEN USE THE UP OR DOWN ARROW TO CHANGE THE NUMBER

SHUTDOWN

ENTER / RESET

Once 5309 appears on the display, Press the Enter/Res Button and the words "***INSTALLER CODE***" will start ***flashing.***

You are now ready to use this ***Quick Set Up Sheet !***

Please do not substitute the Quick Set Up for the Service Manual

IT IS STRONGLY RECOMMENDED THAT THE SERVICE, INSTALLATION, AND OPERATION MANUALS BE READ IN THEIR ENTIRETY PRIOR TO USING THIS SHEET

Continued

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Page 2 of Lochinvar Quick Set Up Sheet

First, set the Time and Date In the *General Menu or "A"*

Press and Release the Enter Button when the Caret > is on "A"

Arrow Up to the A3 Menu to set date and time

You will see the following:

YY	MM	DD	HH	MM	W
Year	Month	Day	Hour	Minute	Day of week

Now arrow Right to move through each digit or left to move back.

When at the digit you wish to change, Press and Release the Up/Down Arrow until each has the correct number. Once finished, Press and Release Enter

This will be a "W" . Next to the "W", use the up/down arrow to place a number in the digit space. For Sunday, use 1, and Monday 2, and so forth.

When finished, Press and release Enter. This will get you back to the Main Menu

Now, Arrow over to "B" or Temperature Settings

This is for SETPOINT USE ONLY
For Outdoor Weather Responsive go to "F"

				Go to Page
TEMPERATURE SETTING	B	1	SH Set Point User	17
		2	SH Minimum Set Point	17
		3	SH Maximum Set Point	17
		4	SH Offset	17
		5	SH Differential	18

B-1 is the Space Heating Setpoint or Temperature of Supply Water when Setpoint Contacts are made. You may have a pool or spa heat exchanger that you want to always see a 140 F across the heat exchanger when calling. This is factory set at 125 F and is adjustable from 50 F-190 F

B-2 is the Minimum Setpoint. Since this is a condensing boiler, there isn't a minimum setpoint unless your system needs one. If you have air handlers for instance, you may want 120 F, is so, arrow up and Press and release Enter.

B-3 is the Maximum setpoint and is factory set at 190 F. Leave this at the factory setting.

B-4 Offset, Factory set 10 Degrees, arrow up to 20, press Enter

Continued

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Page 3 Lochinvar Quick Set Up

For DHW Programming

With Installer Code programmed in, while still in Menu...Go to "E"

E-1 is the DHW Target Temperature for Boiler Water is Factory set@149 F

E-2 is the Switching Time, Factory set @ 30 Minutes, leave at the factory setting. This will cause the boiler to go back to heating mode if the DHW target temperature isn't satisfied after 30 minutes.

E-3 DHW Tank Temp, Factory Set @ 124 F

Press and Release Menu/Exit Once to Go to the next Menu

The Next Menu if **"F"** and is for Weather Responsive Control when using an ***Outdoor Sensor***

F-1 Minimum Air Temperature Factory Set at 25 F Arrow Down

to 10 F

Press Enter

F-2 Max Air, Factory Set at 70 F, Leave at the factory setting. This is where the boiler will begin to heat the water to Minimum Supply Temperature but is not Warm Weather Shut Down

F-3 Max SH Set Point, Factory Set at 180 F, Arrow down

to 160 F

Press Enter

F-4 Minimum SH Set Point, Factory Set at 70 F, Arrow Up

to 100F for Baseboard

or 120 for air Handler and Press Enter

F-5 Outdoor Air Shutdown, Factory Set to 80 F, Arrow Down

to 70 and

Press Enter

F-6 Outdoor Air Differential Factory Set at 10 F, Arrow Down

to 2 Degrees F, and

Press Enter

Continued

DRAFT COPY

Lochinvar Quick Set Up Sheet

F-7 Shift Reset Curve, Leave at Factory setting or “No Shift”

F-8 Boost Temperature, Leave

F-9 Boost Time, Leave

Press Menu Exit

Twice To Exit Program/Installer Mode

The **“J”** Menu is the Service level menu and will only need to be entered into if the “SERVICE DUE” is flashing every five seconds.

SERVICE NOTIFICATION			
	J	1	Service Notification in Month
		2	Service Notification Running Hours
		3	Service Notification Boiler Cycles
		4	Reset Service Notification Counter

If **“Service Due”** is Flashing, Enter Installer code on page one, then Press Enter

Press and Release **Reset**

button Once and display will read reset “yes”

Press and Release Enter

Once and display will read “Engaged”.

Control is now reset for **“Service Due”**

Press and release

Menu/Exit twice and you are back to operating mode

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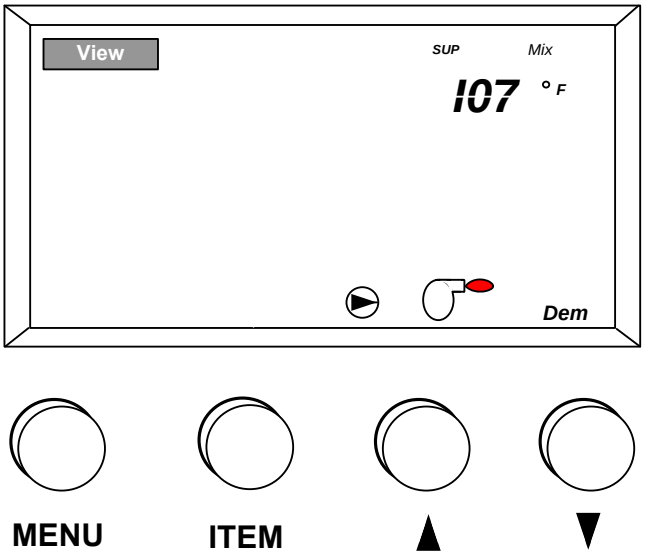


Radiant Mixing Block™

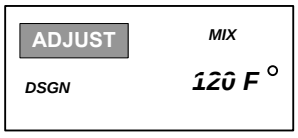
PATENT PENDING RMB-1

For use as a Boiler Control or Radiant Heating Control

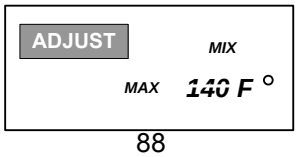
1.) Push and release the **Menu** button and the **ADJUST** menu will appear with the first item being Outdoor Design

2.) The **Mix Design Temperature** will appear. This is the temperature the system will achieve when the temperature outdoors reaches the **OUTDOOR DESIGN TEMPERATURE** setting.

This temperature is the one that will determine what supply temperature will go out to the supply tubing during Design Conditions. For example, if the **OUTDOOR DESIGN TEMPERATURE** is 10 F and the **MIXING DESIGN TEMPERATURE** is 145 F, the supply tubing will receive 145 degree temperature at a temperature of 10 F outside. When the Outdoor temp goes below 10 F such as 9 F, the **MIXED SUPPLY TEMPERATURE** will assume the temperature set into the Mix Max Temperature setting. (This comes right after Mix Design Temp in the Adjust Menu).

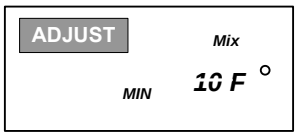


3.) Push and release the Item button: The next item to appear will be the **MIX MAX TEMPERATURE**.

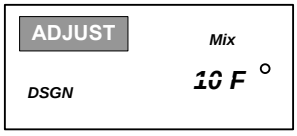


Continued on next page

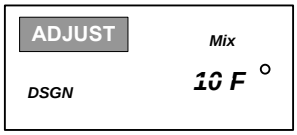
4.) Push and release the Item button: The next Item to appear will be the **MIX MINIMUM** will appear. This is the temperature you will set the supply water to be when you want to accomplish floor warming. For instance when it is 65 degree Fahrenheit outdoors, there will be little warmth to the supply water going out to the floor unless this is set to a minimum. To accomplish floor warming, this should be set to approximately 77-80 degrees supply temperature, tested, and adjusted to be sure we do not override the desired room temperature.



5.) Push and release the Item button: The next item to appear will be the **Warm Weather Shut Down**
Is the temperature at which the system will shut down when it matches the measured outdoor temperature.



6.) Push and release the Item button: The next item to appear will be the **Unit of Temperature** and we can choose what temperature we want the unit to work in (either Celcius of Fahrenheit.



This concludes the instructions for the Adjustments portion when using this RMB as a weather responsive control. If using as a setpoint control to keep a surface at one temperature, read ahead.

TO SET UP AS A SETPOINT CONTROL, YOU WILL ADJUST **ONLY THE FOLLOWING**:

1. **MIX TARGET**: The temperature you want the supply water to achieve. The Outdoor Sensor must be set to “OFF”.

2. **DELTA T MAX**: This is the temperature you will want to keep the supply and return from exceeding. For slabs, this is usually 40 degrees F so as not to stress the concrete.

3.) **OUTDOOR DESIGN TEMPERATURE**: This must be set to “OFF”

4.) **BOILER MINIMUM**: For natural or propane gas fired cast iron section boilers, set this to 140 degrees F. For Oil fired cast iron sectional boilers set to 127 degrees F, and for natural gas fired condensing boilers, set to “OFF”.

Continued on next page

5.) **Units of Temperature**: Set to Fahrenheit or Celcius.

Dip Switches

1.) Behind the front panel where programming is done, if you remove the display, you will find the dip switches. On the top right you will see the **on/off** dip switch. If this is turned “on”, the RMB will “control the boiler. This means it will bring the boiler on and maintain a minimum temperature without a demand for heat. If it is set to “off”, the RMB will only bring the boiler to minimum temperature when there is a demand for heat.
2.) The “**Manual**” switch is located down to right near the bottom and is used to test all functions, similar to an over ride switch. It turns everything “On”. When looking for “automatic operation, leave this in the opposite position.

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02/23/2007
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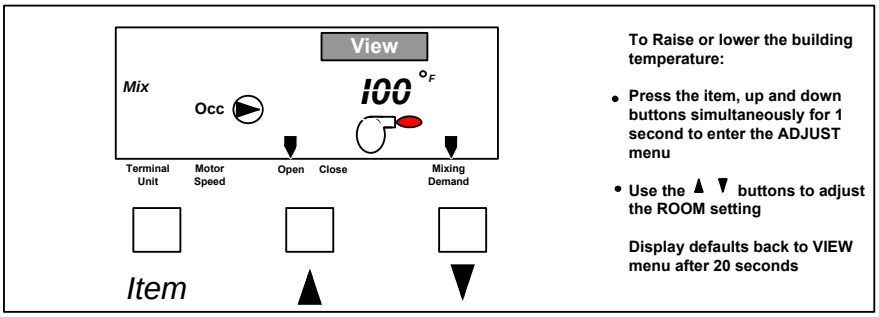
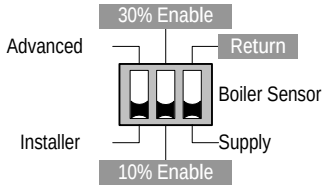
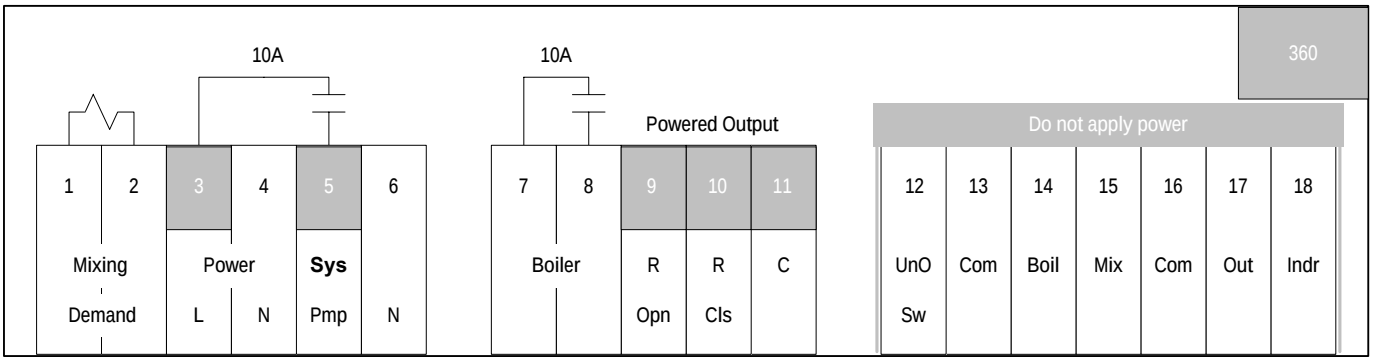
Quick Check List for Tekmar 360


View
Mix
Occ
100 °F
Terminal Unit
Motor Speed
Open
Close
Mixing Demand
Item
To Raise or lower the building temperature:
Press the item, up and down buttons simultaneously for 1 second to enter the ADJUST menu
Use the ▲ ▼ buttons to adjust the ROOM setting
Display defaults back to VIEW menu after 20 seconds





Dip Switches: When to flip them, what they do and how they affect things.

1.) **Advanced**: This is the position the dip switch should be in for the installing contractor to make adjustments.

2.) **Installer:** This position is the position to leave the control in so that the homeowner or building owner will not be able to change the settings. By having “Installer” labeled on the switch it causes the reader to think it is the position to be in to do most anything. Always flip the switch back to “Installer” When finished making adjustments.

3.) **The 30 % / 10% Enable** dip switch is *only functional when* the boiler sensor dip switch is set to “Return”. If the Boiler dip switch is set to “Return”, choosing 30% or 10% will allow the control to activate the Boiler contacts # 7 & 8, when the mixing valve is within 30% or 10% away from fully open. In other words, when the valve is 70% or 90% of fully open, the “Boiler” contacts #7 & 8 will make contact.

4.) **Boiler Supply/Boiler Return**: for systems where the 360 control provides a heat demand to an external boiler control, the boiler sensor should be installed on the return side of the boiler loop. When the boiler sensor is installed on the return side of the boiler loop, the Dip Switch must be set to “Return”. The 360 control enables the boiler when the position of the mixing valve exceeds the boiler enable DIP switch setting.

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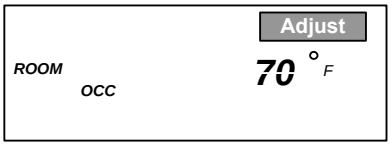
(Continued from previous page)

The Boiler contact is controlled by several things. The boiler contact wil make whenever there is both a mixed demand (the arrow above mixed demand is displayed in the LCD screen) and the “Boiler Min” temperature setting is measured at or below by the Boiler Sensor. For instance, it is quite common to have a “Boiler Min” temperature of 140 degrees F for a natural or propane gas fired, cast iron sectional boiler. This is necessary because the condensation temperature (or dew point) is 136 Degrees F for natural ans about 135 degrees F for propane.

For condensing gas boilers, this setting is set to “Off. And for Oil fired boilers, the condensation temperature (dew point) is 118 degrees F. With oil, we usually set the minimum temperature to about 127 degrees F

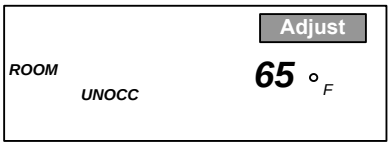
QUICK SET UP

1.) Hold the three buttons in simultaneously for one second and **Adjust Menu** will appear.



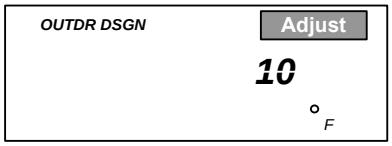
The first thing to be displayed will be the Room Occ which typically gets set for 70 degrees F. You may turn this up or down using the up/ down arrows. This will remain the room temperature target setting until and if power is applied to the Unocc and Common terminal. The raising and lowering of this setting directly affects the “Mixed Target” temperature as well as the “Boiler Target” temperature. Adjustable from 35-100 F

2.) Press the item button and the next adjustable item will appear



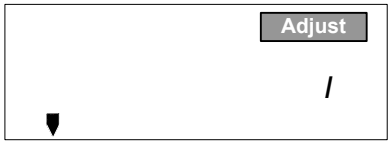
This is the Unoccupied room temperature setting and is usually not used. It is only functional is power is applied to the “UNOCC/ COMMON” terminals.

3.) Press the Item button again and the next item to appear will be the **Outdoor Design Temperature**



The Outdoor Design Temperature is meant to be set at the very coldest outdoor temperature seen all year. We like to see this set at 10 degrees above zero so that your Mix Max temperature will be achieved before we see outdoor temperatures as low as 0 degees. Adjustable from -60-32 F

4.) Press the item button again to advance to the OUTDR DSGN adjustment



This is the terminal Unit Adjustment See Next Page for Choices and Settings

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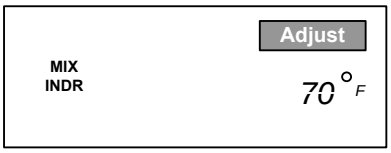
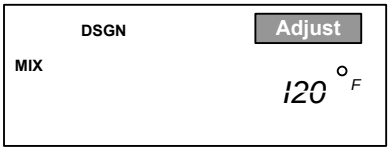
Terminal Unit	High Mass Radiant 1	Low Mass Radiant 2	Fancoil 3	Fin-Tube Convector 4	Radiator 5	Baseboard
MIX DSGN	120 F	145 F	180 F	180 F	160 F	150 F
MIX MAX	140F	150 F	200 F	200 F	180 F	170 F
MIX MIN	Off	Off	115 F	Off	Off	Off

6.) Press Item again and the **Mix Indoor** will appear



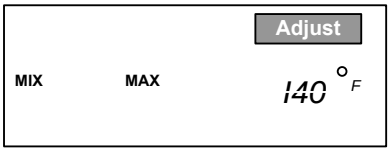
This is the (**design**) indoor temperature used in the heat loss calculation for the heating system. Adjustable from 35-100 F

7.) Press the Item button again and the **Mix Design** temperature will appear.



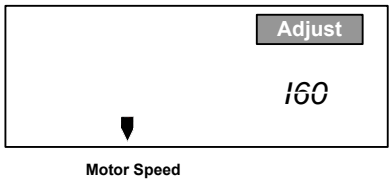
This is the (Design) temperature of the supply water used in the heat loss calculation of the system. Adjustable from 70-220 F

8.) Press the Item button again and the **Mix Max** temperature will appear



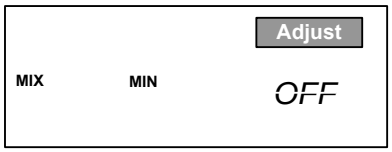
This is the Maximum temperature of the supply water used in the mixing system. Adjustable from 80-210 F

9.) Press the Item button again and the **Motor Speed** will appear



This is the mixing valve actuator motor speed in seconds from fully closed to open and vice-versa. This is adjustable from 20-230 seconds

10.) Press the Item button again and the **Mix Minimum** will appear



This is usually off. In cases where floor warming (such as with tile flooring) is desired, a temperature of somewhere between 77-80 degree supply water temperature will act to take the chill off of the tile without heating the room (in most cases). In some cases, floor warming will in fact heat the room.

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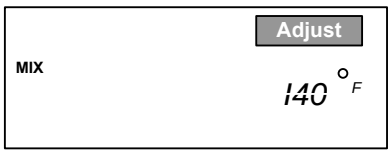
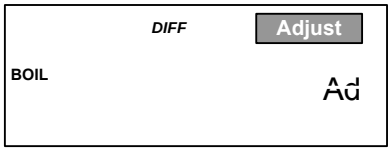
11.) Press Item button again and **Boiler Minimum** will appear



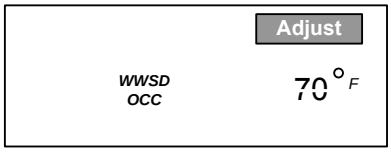
This is the minimum temperature the boiler will be allowed to be when a mixed demand is present. With Natural or Propane gas fired Cast Iron sectional boilers, this is usually set to 140 F. This is done to prevent flue gas condensation. With gas fired condensing boilers this is set to off.

12.) Press Item button again and **Boiler Differential** will appear



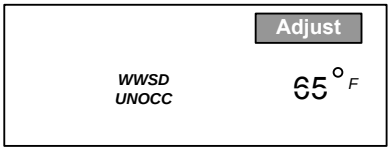
The differential that the control is to use when it is operating the boiler. (BOILER SENSOR DIP SWITCH= Supply AND Boiler Sensor is present)

13.) Press Item button again and **Warm Weather Shut Down OCC** will appear



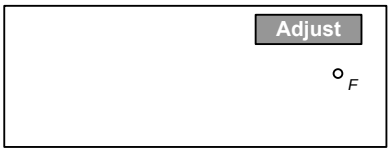
This is the outdoor temperature measurement at which the control will discontinue allowing regular heat to operate during the OCCUPIED mode.

14.) Press Item button again and **Warm Weather Shut Down UNOCC** will appear



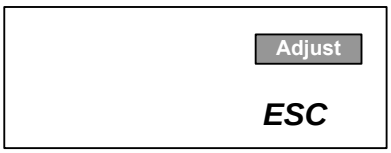
This is the outdoor temperature measurement at which the control will discontinue allowing regular heat to operate during the UNOCCUPIED mode.

15.) Press Item button again and temperature units **F° or C°** will appear



This is the point where the units of measure are chosen. The two choices are Fahrenheit and Celcius.

16.) Press Item button again and the **ESC** will appear



This item exits the ADJUST menu by pressing either the ▼ or ▲ button.

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Viessmann Vitotronic 200 & 300 CHEAT SHEET The manuals for Vitotronic controls have got all the information you would need. However, in some cases, it may be more information than you want. Here is a cheat sheet with common coding addresses and error messages you might need. Programming is done from coding level #2.

To get to Coding #2, hold in <u>faucet</u> and <u>faucet/radiator</u> buttons for 2 seconds. Then scroll to address with + and - buttons

		Change coding to
To change from Celsius to Fahrenheit		88 : 1
For lead lag boilers or 2 stage		02 : 1
No DHW production (with #5 sensor removed)	Boiler	00 : 1
	Mixing valve	00 : 3
	Boiler/mixing	00 : 5
Eliminate priority on DHW		A2 : 0
Load dependent switching differential	(11-22F)	04 : 1
	(11-36F)	04 : 2

Vitotronic is smart and has *automatic sensor recognition*. If you plug in a DHW or mixing valve sensor even for a minute, it programs itself. If you don't want DHW during construction and you have plugged in the sensor, you must go into coding 2 and clear it out at address "00" (see above)

Error messages (page 37 –39 Vitotronic 200 manual)
The screen will tell you by number and word what sensor is giving the fault.

"10" - Outdoor sensor shorted. "18"-Outdoor sensor open
"20" – Mixing sensor shorted. "28" – Mixing sensor open
"30" – Boiler sensor shorted. "38" – boiler sensor open
"50" – Tank sensor shorted. "58" – tank sensor open
"d1" – Burner lockout

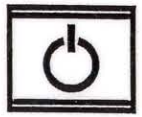
Relay test
You can check every line voltage output (pumps, burner, mixing valves), by pressing the **<u>OK</u>** and **<u>standby</u>** button for two seconds, then scroll through outputs with + and – buttons.

Diagnosis Mode
This is a powerful feature of Vitotronic. You can see what the control has as a desired temperature versus what the actual temperature is. To get to diagnosis, press the **<u>standby</u>** and **<u>faucet/radiator</u>** button for 2 seconds. Then scroll through the selections using the + and – buttons.

Caution!!!! Alert!!!!
This control comes through programmed to send the building to 37F at 10 PM!. Please press the thermometer/moon button and change temperature with + and – buttons. This must be done for both circuit 1 & 2 (Vitotronic 200) and circuits 1,2 & 3 for Vitotronic 300.

VITOTRONIC 200
Accessing service levels

VIESMANN

Function	Button Combination (Press and hold for 2 seconds)	Exit
Diagnosis		Press OK
Relay Test		Press OK
Coding Level 1		Press  and
Coding Level 2		Press and

CONVERSIONS

CONVERSION FACTORS					
1 U.S. Gallon	Equals	231 Cubic Inches 0.1337Cubic Feet 3.785 Liters 0.833 Imperial Gallons	1 Cubic Foot	Equals	7.48 U.S. Gallons 0.0283 Cubic Meters
			1 Liter	Equals	0.264 U.S. Gallons
1 Imperial Gallon	Equals	1.2 U.S. Gallons	1 Cubic Meter	Equals	35.314 Cubic Feet 264.2 U.S. Gallons 999.97 Liters

CONVERSIONS		
To Convert This…	**To This..**	**Multiply by This…**
P(kW) Kilowatts	**HP** Horsepower	kW x 1.34= kW ÷ .746=
BAR Of Pressure	**PSI Absolute (PSIA)** Pound per square inch of pressure(includes atmospheric pressure at sea level)	BAR x 14.5 + 14.7=
BAR Of Pressure	**PSI Gauged (PSIG)** Pounds per swuare inch of pressure as it would be read on a pressure gauge (does not include atmospheric pressure)	BAR x 14.5 =
PSIG Gauge Pressure	**Head, Feet**	PSI x 2.31 ÷ SP.GR=
Millimeters	**Inches**	(mm) x .0394=
Meter	**Feet**	(Meters) x 3.28=
Centimeters	**Inches**	Centimeters ÷ 2.54=
° C Degrees Celsius	**° F** Degreese Fahrenheit	° C (9/5) + 32=
Watts	**Horsepower**	Watts x .001341=
Watts	**Btu/hr** British Thermal Units Per Hour	Watts x 3.4127=
kW	**Btu/hr**	3412 BTU's=1 kW
Boiler Horsepower	**Btu/hr**	Boiler Hp x 33479=